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FARM ANIMAL WELFARE:

CRISIS OR OPPORTUNITY FOR AGRICULTURE?

Marlene Halverson

Fifth Printing
Updated, with Editorial Corrections,
September 1991

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CONTENTS

FARM ANIMAL WELFARE:
CRISIS OR OPPORTUNITY FOR AGRICULTURE?*

Marlene Halverson **

Introduction

Thank you for inviting me to come and speak to you today about the subject of farm animal welfare. Animal welfare represents both crisis and opportunity for agriculture and the industries associated with it. It is a subject, therefore, we in agriculture must take care to understand and appreciate.

This presentation will cover the following three general areas:

1) I would like to clarify some terms. Specifically, I would like to clarify the difference between the welfare of animals and individuals' views about the rights that animals may have. I think confusion in this area is unnecessarily muddying the debate.

2) I would like to give a rather extensive but simplified description of current thinking in the science of animal welfare. This will be important for an understanding of the subject. For this purpose, some charts and photographic slides, including some of swine in intensive, close confinement production -- that is, long-term housing in individual crates -- will be shown. The purpose is not to evoke an emotional response, but to illustrate some points about stress and animal behavior. The emphasis will be on swine production systems, since that is my area, but a large scientific literature regarding the welfare of other domesticated livestock exists for those who are interested in further research.

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* This paper is based on a presentation by the author to the North Central Chapter, National Agricultural Marketing Association, Marriott Hotel, Bloomington, Minnesota, November 12, 1990.

** Thanks are hereby given to those who reviewed and commented on earlier versions of this presentation; to those who supplied photographs and information: Bo Algers, Department of Animal Hygiene, and Hans Andersson, Department of Economics, Swedish University of Agricultural Sciences, Pablo Arellano, Department of Large Animal Clinical Sciences, University of Minnesota, Diane Halverson and Christine Stevens, the Animal Welfare Institute of Washington, D.C.; to Connie Charipar of the University's Printing and Graphics Department for preparing the photos for duplicating; to Larry Etkin of the University's Educational Development System for technical assistance; and to numerous student colleagues who were generous with time, advice, and encouragement.

3) Finally, I would like to talk about how I see animal welfare relating to the business of agriculture and to the choices agriculture faces. My conclusion is that there is no reason why a technologically advanced society such as ours cannot design and manufacture technologies which will meet important welfare criteria for the animal, and be profitable for the farmer, **if** we have the motivation to do so. In this, I believe, lies an attainable middle ground. Those who advocate abstention from animal use are in the minority. The majority of those individuals who express concern, who sit down in front of a piece of chicken, or beef, or pork, simply are interested in knowing if the animal led a reasonable life.

To date, most of the attention has been focused on the "crisis" presented by public concerns about the welfare of farm animals. Headlines in farm magazines declare that "Animal Welfarists Seek Your Demise" and, under banners such as "Down With the Farm," writers describe initiatives by welfare and rights advocates as "thinly veiled cover(s) for an attempt to smother all forms of agriculture." Often the end of agriculture itself is the predicted outcome. I don't think we have to worry about that. Since we must all eat to live, and since meat is a very important source of concentrated protein in our diets, the demise of animal agriculture -- and certainly the demise of agriculture itself -- hardly seem likely.

There are these important points to be made from the start.

First of all, it is useful to distinguish between animal welfare and animal rights. The welfare of an animal is subject to determination and measurement by scientific means. Animal rights, as an ethical concept, belongs to the realm of moral choice. In the animal rights philosophy animals are endowed with innate and inalienable **rights** analogous to those many civilizations have recognized as human endowments. The study of animal welfare, on the other hand, recognizes that animals experience a **welfare status**, that is, a state of being (good or poor or in between) resulting from their interactions with their environments. In combination with other environmental factors, human management and husbandry of animals are important determinants (for better or worse) of the welfare status of animals being used by humans. However, they are not equivalent to animal welfare, just as animal care and animal welfare are not equivalent concepts.

Second, if we appreciate these distinctions, we will also recognize that where people express concern about the welfare of animals in livestock production systems, it is not about whether or not humans should use animals at all, but about **how well** we use them, **how well** we make provisions for the quality of life they experience while they are in our care.

Third, consumers have the right to challenge agriculture on this and on other matters respecting how agriculture meets its social responsibilities. They, as well as we, after all, eat the food we produce and they, as well as we, live in the environment we create.

Animal Welfare and Animal Rights

"Welfare is defined to be the state of an individual as regards its attempts to cope with its environment" (Broom 1988). There is something important to note about this definition and that is the term individual. Welfare is not a broad ecological concept such as species preservation; it does not refer to populations, such as herds or flocks. It is not an environmental concept: human and non-human animals stand in the same relation to their environment. Welfare relates **specifically** to the **well-being** of **individual** animals.

An illustration of this distinction between individual welfare and broader ecological questions is given by the case of the musk deer of Asia. In some areas of Asia, this small deer is hunted for its musk. Trade in musk is so lucrative that the deer is in danger of extinction. In other areas, the deer is "farmed." That is, it is kept in captivity and its musk is periodically extracted. From an ecological viewpoint, if musk is to be harvested, farming a few of the animals and preserving the species clearly is preferable. However, from the welfare perspective, hunting may well be preferable to the techniques used in farming this wild deer. [1] On musk farms, male deer often are kept in wooden boxes that are only slightly larger than they are and sometimes too low for them to stand, through which no light enters, and are fed and watered sufficiently to keep them alive. Periodically, they are dragged from the boxes so the musk can be extracted. Following its extraction the deer are returned to their boxes. There is little profit incentive to provide for the animal's broader welfare. The musk deer's physiological program is such that it produces musk.

When we speak of an ideal level of animal welfare, this is defined to be "a state of **complete physical** and **mental** health in which the animal is in harmony with its environment" (Wood-Gush 1983). So there are two critical components of animal welfare: basic physiological health, hygiene, and comfort of the animal **and** mental, or psychological, health of the animal. Taken together, these two components define the "quality of life" or level of welfare the animal experiences.

Livestock housing in commercial agricultural production is intended to enable animals to achieve near-optimum performance in growth, productivity, and reproductivity (Hahn 1982). Theoretically, if the animal does not have to search for food, defend self and offspring from predators, and use calories to adjust to cold temperatures, it will direct those energies to growth and reproductive performance. By providing adequate food and water, warmth, and shelter, modern intensive confinement production methods have succeeded in significantly limiting some of these natural stressors. But they often fail to consider the motivational systems of the particular animal species for which the buildings are intended. By this is meant that they do not allow the performance of many normal behaviors, such as walking or turning around, or many behaviors that animals may be very highly motivated to perform, such as dustbathing in chickens or nestbuilding in swine or play and grooming in calves. This, as we shall see, often leads to distress (Vestergaard 1981; Van Putten 1988). Moreover, in the past few decades, livestock housing has assumed the additional role of confining the animal component of a farm to a small area of the farm acreage in order to economize on labor and to devote land to the more profitable use of growing crops. As pressures grow to divert farmland to non-agricultural uses, this pressure to concentrate animal

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[1]. If, in hunting, the animal is shot cleanly and death comes instantly so that it does not experience fear or pain, its welfare is not in question. If the animal dies a long and painful death, then its welfare is affected negatively (Broom 1988). This is quite apart from the question of whether or not taking the animal's life violates a right.

production in small areas may increase. In minimizing the amount of land area devoted to animal production, the amount of space allocated to each animal is also limited. Often, the limit is the ultimate constraint -- the size of the animal itself.

It is very important to recognize that when advocates for animal welfare recommend change in livestock production systems, or when scientists and engineers design production systems that take welfare into account, in addition to improving contributions of design and management to physical health of the animals, they are responding to a perceived neglect, in modern production practices, of the **mental** dimension of health and well-being. Their goal is to achieve a positive level of **total** welfare. This level of total welfare is determinable by physical measures of general health and soundness; by observations of the animal's behaviors (the science of ethology); and by neuroendocrine analysis.

So, welfare exists on a continuum from very good to very poor (Baxter 1983). Given an appropriate amount of time, in a controlled setting, its degree can be assessed precisely, in a scientific way (Broom 1988). What we find can then be used to evaluate welfare of animals in an applied setting. The question that must be asked after a welfare evaluation is made is the moral choice: "How poor must the welfare be before people consider it to be intolerable?" (Broom 1988). On this question, not surprisingly, people's views differ.

Some people believe that human and non-human animals have equal rights. In particular, they believe non-human animals have the right not to be used for any purpose by humans. This is an **extreme** animal rights position. Note that not all animal rights philosophers or activists subscribe to this extreme position (moreover, very few of them resort to extremist tactics of misrepresentation or violence to defend it), and that for some these rights are innate and inalienable while for others these rights are perceived to be in the nature of property rights, transferred or extended by caring humans. Note, also, that in advocating no use of animals at all, the **extreme** animal rights position really is **not related to** questions about the **welfare** or quality of life of the animal in the course of food production or other use by humans.

A different **extreme** is represented by the belief that humans have no obligation at all to consider the welfare of animals in food production. All that matters is productivity because animals exist specifically for humans to use and have no intrinsic value or internal purpose. Note that this view also **does not relate to** the question of **welfare**, as defined above to include both mental and physical aspects.

From this, it should be obvious that when two people representing each of these extreme views are pitted together in a debate, a lot of heat and a lot of friction, but very little light, are generated. In particular, very little information or understanding can be generated regarding the questions surrounding the welfare, or the well-being, of individual farm animals during the course of food production.

Somewhere in the middle are those who do not oppose human use of animals but believe the quality of the lives animals are allowed to live while they are under human care (their welfare) should be considered in the course of food production. This is the position of most main line animal welfare organizations and characterizes the views of many farmers who regard their livestock as more than mechanical inputs in the production process.

But these views are all in the realm of moral choice. Although organizations concerned with the welfare of farm animals see advocacy on behalf of animals to be their moral choice and may broaden their interests as well to ecology and the environment, welfare itself and the moral choice taken with respect to it are different concepts. [2]

The Scientific Basis of Welfare

Recall that when we are speaking of the welfare of farm animals, we are speaking of the quality of life the animal leads in production, and for which there is growing public concern. Recall, as well, that welfare has both physical and mental health components.

To date, the most progressive research in farm animal welfare is being conducted in Western Europe and Scandinavia (Halverson, D. 1982/3; Animal Welfare Institute, 1987). First, let's look at behavior, structuring our discussion with a model of behavior being used in these countries to study welfare. Later, when we discuss some misconceptions concerning animal welfare, we will look at the role of neuroendocrine analysis in correlating behaviors with levels of stress or distress.

There are various possible behavioral models that could be used, but this one will serve our rather general purpose. Underlying the model is a scientific perspective that animals have histories based in the two life processes: phylogeny (the biological history of a species as laid down in its genetic program or pattern, i.e., by process of natural selection) and ontogeny (the animal's own individual history as experienced during its interactions with its own environment and laid down in its individual memory). By environment is meant those parts of the animal's surroundings that can be perceived, experienced, and influenced. Later when we talk about the "natural" environment, we will mean by this the animal's environment when "free" from human influence or alteration, while "semi-natural" will refer to scientists' attempts to approximate or simulate conditions of a natural environment for the purposes of experimentation. (In both cases, it is recognized that it is difficult, if not impossible, for an environment to be entirely free of human influence.)

The behavioral program the animal resorts to in order to change aspects of its environment is depicted in the next two models (Wiepkema 1983).

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[2].. Broader environmental concerns are not inconsistent with concerns about the welfare of individual animals. Habitat destruction, for example, affects the welfare of the individual animals whose habitat it is. Later we will explore the connection between farm animal welfare and sustainability of agricultural systems.

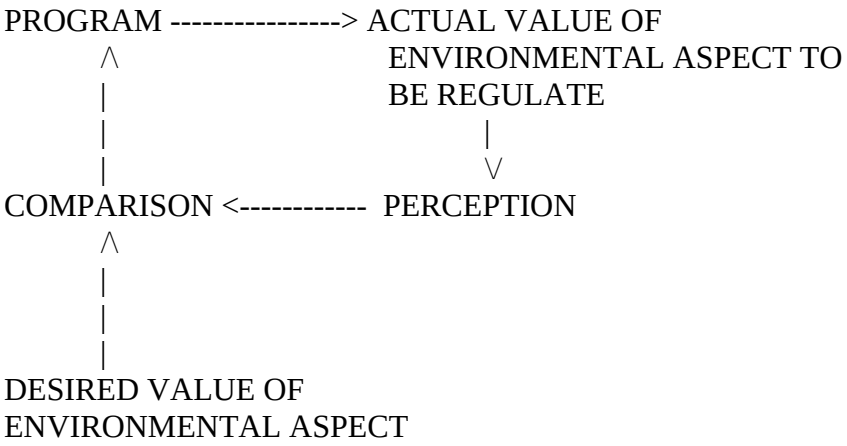

Figure 1.

In the model in Figure 1, the animal perceives certain actual aspects of its environment and compares them to the values of the environment that it desires. [3] If the value of the desired environmental aspect and the value of the actual environmental aspect are perceived to be incompatible, a program is set in motion by means of which the animal acts on the environment to remove the discrepancy between the actual and desired environmental aspects.

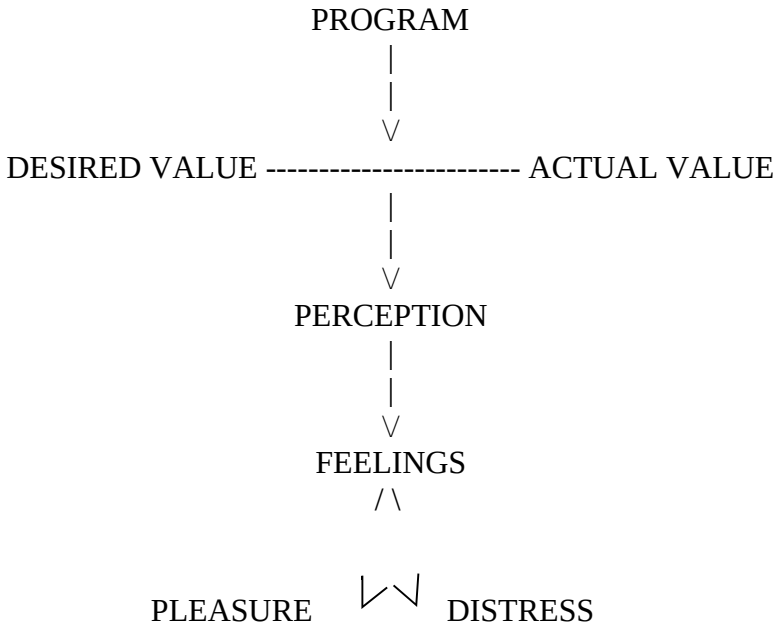

Figure 2.

[3].. Through the process of ontogeny, animals form "expectations about the dynamics of their environment," in addition to the species-specific expectations of their genetic programs. The term "desired," here, refers to expectations formed by both processes: phylogeny and ontogeny.

In the second stage of the model (Figure 2), the animal perceives the results of its actions and again compares the results with its desired environmental aspect. If the action taken has been successful in bringing together the desired and actual environmental aspects, the animal will have achieved the desired harmony with its environment, and pleasure will be felt. If the animal's behavior has been unable to effect the desired change, distress will be experienced. As we shall see later, severe distress results in the activation of internal, non-behavioral mechanisms to achieve the desired harmony.

In any environment, but in particular, in any production situation where the animal is allowed to use behavior to cope with its environment, two environmental conditions must be satisfied in order to provide for the animal's welfare (Stolba, 1982; Bresson, 1982; Dantzer, Mormede, and Henry, 1983). These are predictability and control, in particular, control over stimuli occurring in the environment.

Predictability implies that the actions the animal takes have the outcome it expects based on its own history or experience (its ontogeny, again) and the biological history of its species, or its genetic pattern (phylogeny). Predictability usually occurs in nature because, over time, through natural selection, the species has adjusted to the natural environment and, through learned behaviors, the individual becomes familiar with the conditions of its own immediate natural environment. In the production environment, predictability needs to be provided for by conscious human design and management.

Control implies that the animal is able to perform certain behaviors with respect to its environment that may be necessary for survival, for comfort, to relieve stress or boredom, or to escape from undesirable stimuli. In the production environment, this implies that the animal should be able, for example, to move from shade into the sun if the temperature is too cool, or to wallow or turn on sprinklers, if the temperature is too hot; to root in straw or litter or chew it and move it about, for occupation. [4] It may mean providing the space and materials for a sow to build a nest before farrowing. This implies the environment must be enriched to allow engaging in these behaviors. Animals should be able both to receive and to react effectively to feedback from their actions. Stimuli should not occur in the environment in such a way that the animal cannot react to them effectively, e.g., constant loud noise that may cause distress but from which the animal is unable to escape (Friend, personal communication, 1990). [5]

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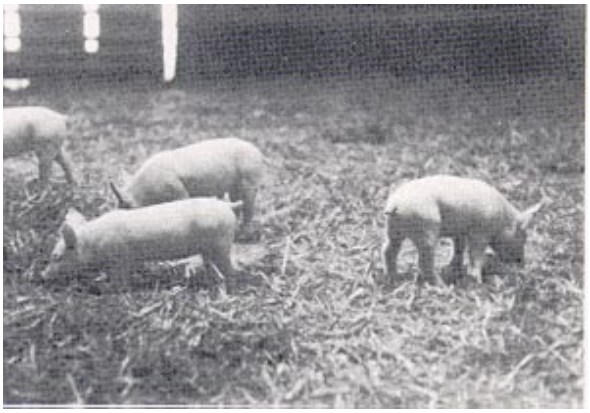
4. Animals will adjust aspects of their environments to fit their preferences, if given the opportunity. Curtis (1983) has described a means by which pigs themselves can control the thermal settings in their housing environments.

5. There are other more fundamental forms of control that are not often included in discussions about welfare, but probably should be. These are in the nature of the animal's control over its own body characteristics. By genetic selection we have bred animals for certain characteristics that have, in turn, eliminated certain other capabilities which would be fundamental to their survival in a natural environment. An example is control over their own reproduction. For example, in Belgium and Northern France, the Belgian Blue cow has been genetically selected for large calf size, resulting in a high proportion of deliveries being made by caesarian-section. Bull dogs, genetically selected for large heads and small pelvises, also often need to be delivered by c-section. Whether humans have the right to select in this manner is an ethical question, and subject to debate. On the other hand, the welfare effects of genetic selection in the cases of Belgian Blue cows and bull dogs seem more clear because they are physiologically obvious, that is, they entail surgery. Detrimental physical welfare effects have been shown in transgenic pigs although scientists remain optimistic about the possibility of future technical developments to reduce these effects (Pursel 1987; Pursel, et al. 1989). Pigs treated with

Sow in Fresh Bedding



Piglets Busy in Straw

As are all domesticated livestock species, swine are social animals, form complex social structures, and engage in social interactions within those structures. The opportunity to engage in social interaction should be allowed for in the production environment (Sainsbury 1986; Stolba

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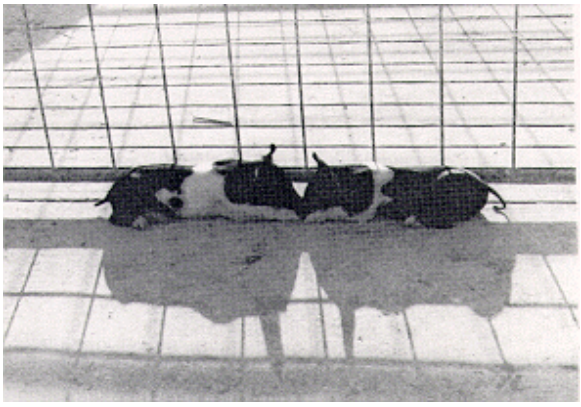
porcine somatotrophin have both reduced appetites and lower levels of subcutaneous fat. Pigs depend on their subcutaneous fat, hair, skin, and metabolism to regulate their body heat and adjust to varying thermal environments. Removal of pigs' control over part (or parts) of their own internal mechanisms of thermal regulation will require humans to adjust the production environments to compensate for that loss of control by the animal. For pigs with exogenously induced (by pST administration) lower subcutaneous fat levels and increased heat-production rate, Curtis (1987) estimated a 6 degree Centigrade increase in lower critical temperature of a 165 pound hog and a drop in the upper critical temperature of a few degrees Centigrade. This implies that temperatures in the production environment will need to be maintained within a narrower range than that required for non-pST treated pigs because the treated pigs will be more sensitive to cold and heat. This will require higher capital investment (in controlled environment facilities) and higher energy usage for producers in less temperate climates. It likely will limit the possibility for producers to trade off feed and fuel inputs as the relative prices of these two inputs change. The welfare of pST treated pigs could be at stake in production systems where the repartitioning technology is adopted but management and facilities are not adjusted to provide the proper environment. The objection often made is that welfare doesn't matter in production animals because they wouldn't have existed anyway if it hadn't been for human intervention. However, the situation must be evaluated on the basis that these animals do exist and that they do have a welfare status that has been, and/or can be, affected by human intervention.

1982; Duncan 1981; Fraser 1988).

Gathering of Pigs



Litt ermates

Halv (photo courtesy of Diane erson)

As with adults, social interaction is important for young pigs. For example, Newberry and Wood-Gush (1986) showed that piglets form strong associations with littermates and that these relationships persist after natural weaning.

Littermates

Piglets Engaged in Playfighting Behavior

Playfighting is also an important activity for piglets. It prepares them for the temporary aggressions that will occur with pigs from other litters when the sow introduces them into the herd (or, alternatively, when the producer mixes pigs from different litters after weaning), thus reducing the likelihood of serious injury when litters are mixed.

One of the most important of the social interactions is that with the stockperson. Consistency in handling by the stockperson, so that feeding times are scheduled for the same hour every day, for example, breeds trust because it fills the need for predictability. Hemsworth and Barnett (1987) concluded that stockperson's behaviors toward pigs have measurable effects on both the welfare (as indicated by corticosteroid levels to measure stress) and the productivity of pigs (as indicated by growth rates and reproductive performance). Pleasant behavior by the stockperson to the pigs (stroking, non-threatening approaches) had positive effects on welfare and productivity, while aversive behavior (kicking, hitting) had negative effects on welfare and productivity.

Often, in intensive confinement production, the two critical conditions of predictability and control with respect to animals' interactions with their environments have been altered or reduced, thereby increasing the likelihood that the animals will experience distress.

Misconceptions Regarding Welfare

I would like to structure the next section of my remarks around two common misconceptions regarding welfare and the implications of these misconceptions:

1) Some people believe that the motivation to perform natural, or inherited (evolutionary), behaviors with respect to the environment has been bred out of modern production animals. According to this argument, if domesticated animals were to be released into a semi-natural environment they simply wouldn't know how to take care of themselves or use its resources.

2) Some people believe an animal wouldn't be able to produce if it weren't experienc-ing good welfare, so productivity must imply that the animal's welfare is good.

Let's look at these misconceptions one at a time.

Misconception Number One

"The motivation to perform "natural" or inherited behaviors with respect to the environment has been bred out of modern production animals."

At least two formal experiments have been conducted to test this assumption for the case of domesticated swine. The first, called Pig Park, was an experimental laboratory set up as a large, partially wooded, partially pasture and marsh enclosure at the University of Edinburgh in 1978 (Stolba, 1983; Stolba, 1982). Ethologists David Wood-Gush and Alex Stolba introduced domesticated Large White pigs into the enclosure. The Stolba-Wood-Gush experiment was the first experiment designed specifically to observe the natural behavior of domesticated pigs for the purpose of determining which behaviors seemed most important to the animals and what functions they served.

Sow Gathering Grass for Nest in Pig Park, Edinburgh

(photo courtesy of Alex Stolba)

Among the most important activities Wood-Gush and Stolba observed were nest site seeking and nest building by pregnant sows. The sow above is preparing to farrow, and has just returned from a successful search for suitable grass for building the nest in which she will farrow. In the photo on page 12, she is nursing her piglets in the nest she built.

Sow With Piglets in Nest, Pig Park, Edinburgh

(photo courtesy of Alex Stolba)

From their work Stolba and Wood-Gush drew conclusions about what elements might be changed in the production environment to improve pigs' welfare. From their work it was first learned that, by duplicating certain natural conditions in the production environment, estrus could

be induced while sows were still lactating. The sows could be bred then, litters per sow per year could be increased over those produced in conventional production systems, and weaning could be accomplished more gradually.

A similar Pig Park to the earlier Edinburgh park was set up outside Stockholm in 1985 by Per Jensen of the Swedish University of Agricultural Sciences (Jensen, 1986, 1988; Jensen, et al., 1987). The objective of this research was to study the maternal behaviors of Swedish Landrace sows. In this study, pregnant sows were released into a wooded enclosure and observed over a three-year period between 1983 and 1987. Jensen and his colleagues identified six different stages in the maternal behaviors of the sows in their park:

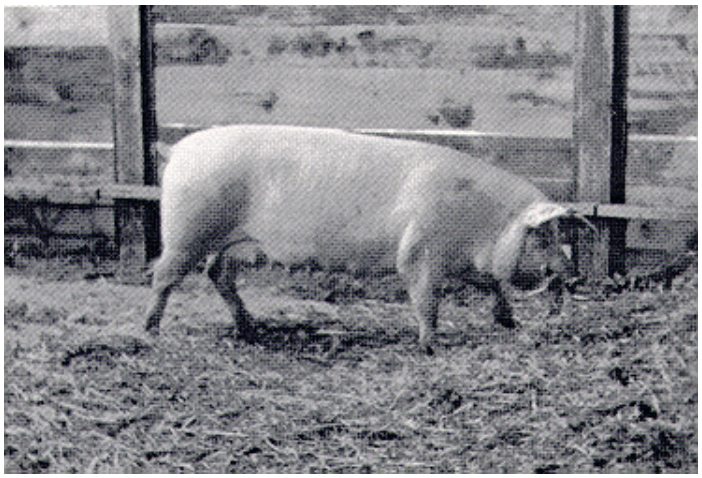
isolation from the group and nest site seeking;
nest building;
farrowing;
nest occupation;
nest abandonment followed by social integration of the piglets into the larger group of pigs; and
weaning.

Sow With Piglets Under Straw in Winter Nest, Swedish Pig Park
(photo courtesy of Per Jensen)

Sow With Piglets to Herd, Swedish Prior to Returning Pig Park

(photo courtesy of Per Jensen)

If the environment provides the opportunity -- in particular, sufficient space and appropriate materials -- sows will exhibit these maternal behaviors in the production environment. This sow, for example, is carrying straw to a corner of a large group pen to build a nest.



Sow Building Nest in Pen

So, as these studies illustrate, the idea that the motivation and capability to perform natural behaviors have been bred out of domesticated swine is mistaken. [6]

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[6]. Wood-Gush, as well as Fölsch and Vestergaard, have shown that battery hens, if removed from their cages to a natural environment and given sufficient time, will adjust to the new environment and soon begin engaging in dustbathing and scratching. A number of production systems allowing for these behaviors have been developed and are in use in Western Europe. Similar behavioral results have been shown when Holstein bull calves were removed from crates and their behaviors observed in open field tests over an 8 week period (Dellmeier, Friend, and Gbur 1990). Motivation to perform highly active locomotor behavior in general

Misconception Number Two

"Productivity and performance criteria are sufficient to indicate welfare."

This common misconception is best illustrated by the following quotation from the March 31, 1990 issue of Pro-Farmer, an industry newsletter:

> There is no better indicator of 'humane' treatment than maximum productivity and efficiency. How could 'mistreated' animals reproduce better or grow faster than 'humanely treated' ones?

What can productivity and performance tell us? Well, they can tell us very little, really, about the overall well-being of the animal in the production system. Animals are genetically programmed to produce. Except under severest deprivation, they cannot help but do so. Also, animals have the ability to adapt to a significant degree to their environments, including painful or stressful ones, although the adaptation may be accompanied by distress (Vestergaard 1981; Van Putten 1988; others). [7] Performance also is boosted by routine addition of antibiotics at subtherapeutic levels in animal feeds to suppress clinical manifestations of disease and increase growth rates. [8]

Quantitative production performance can **only** signify that quality and quantity of nutrients, the water supply, and the microclimate are adequate; that the animal did not contract any clinically-proved illnesses which influenced production yield; and that there are possible genetic differences between animals (Bogner, 1981). While improvements in environmental factors influencing welfare may improve productivity, productivity alone cannot be a sufficient indicator of welfare. For example, it can be **no criterion** as to whether the environmental requirements of the animals concerning locomotion, resting, comfort, social behavior, predictability, and control are met or not. As we have seen, each of these can affect the mental or psychological health of the individual animal. Productivity, growth rate, and reproductive performance are necessary, but not sufficient, indicators of welfare.

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increased with increasing degree and duration of movement restraint, and decreased in response to less restrictive housing.

7. Growth rate also may correlate positively with the presence of stressors in the environment (Friend, et al. 1987).

8. Animals' efforts to adjust to stressful conditions may result in less energy being spent in other important functions, e.g., may lower resistance to disease (Curtis 1982). But, with the availability of antibiotics at relatively low cost, and if the level of investment in existing facilities is high so that welfare improvements would be costly, the productivity effects may not be great enough to require a producer to invest, for economic reasons, in facilities improvements.

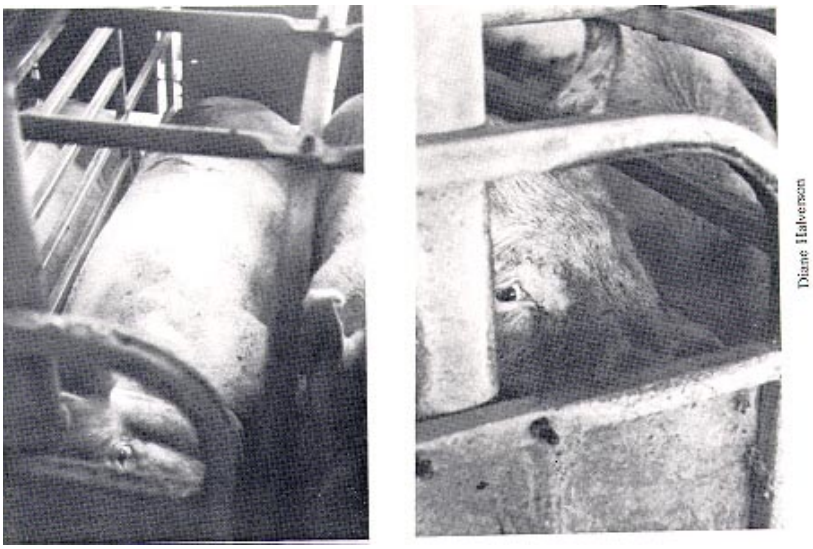
Implications: Welfare-Compatible Production

Improving the overall welfare of animals used in agricultural production, must start from "first principles" (Baxter 1981). Starting from first principles, as in the two Pig Park studies described above, scientists begin with the basics of animal behavior and physiology.

Every animal has a motivational system that consists of both learned and inherited behaviors and governs its interaction with the environment. Compatible with the animal's motivational system is its physiology. Physiology includes body characteristics which are genetic in origin, and the internal mechanisms by which an animal achieves homeostasis, or physiological harmony with its environment. All animals, human and nonhuman, have these characteristics -- motivation and structure -- which complement each other.

For all animals, human and nonhuman, interactions with their environments are less stressful when, by performing certain behaviors with respect to their environments, they can adjust their environments to serve critical needs. Consider again the case for swine. The sow in Pig Park engaged in nest site selection, materials gathering, nestbuilding, and piglet care is showing behaviors that have importance for survival. As the Pig Park experiments showed, these behaviors have not been bred out of domesticated swine. They form a very strong part of the sow's motivational system.

In modern, close confinement housing, opportunities for production animals to undertake any activity in response to their environments are severely diminished. Consequently, the animal's actions to bring the actual aspects of its environment into harmony with the desired aspects may fail. As the following photos illustrate, modern, space-intensive confinement production eliminates the opportunity for almost all normal activities except for eating, sleeping, defecating, urinating, growing, and reproducing.



Gestation Crate (Stall) Housing for Pregnant Sows

Diane Halverson

Sow With Piglets in Farrowing Crate

Intensive Piglet Housing
(photo courtesy of Pablo Arellano)

Crate (Stall) Housing for Boars

When all of the animal's behavioral actions are unable to effect the desired changes in the environment, if its behavioral program is frustrated, or if behaviors with respect to its environment actually are prevented, then the animal must try to adapt to the environment (Dantzer, Mormede, and Henry 1983; Wiepkema, 1984). It must try to achieve some sort of harmony with its environment by internal mechanisms. In the production environment, these internal efforts are sometimes observable as compensating activities. That is, if the animal, through its behaviors, is unable to remove the gap between the desired and actual environmental aspects,

Sow Attempting to Escape from Gestation Crate

if it is unsuccessful in repeated attempts to escape from a crate, for example, it instead engages in a series of non-functional, stereotyped, repetitive, and/or redirected behaviors. These are activities that occur whether an appropriate stimulus is present or not, and they can go on for hours. One such

stereotyped activity, or stereotypy, shown in the photograph below, is barbiting. Stereotypical barbiting is vigorous and incessant biting of the bars of the crate.

Barbiting Behavior of Sow in Gestation Crate

Vacuum activities such as sham chewing are other stereotypies observed in crated or tethered swine.

Piet Wiepkema of the University of Wageningen and his colleagues Cronin and Van Ree (1984) have shown that the stereotyped performance of non-functional behaviors by tethered sows coincides with the release of endorphins in the brain. Endorphin release during stereotyped behaviors is indicative of efforts to cope with extreme stress. These animals have adapted to their environments, but not without "suffering," and they continuously self-stimulate in the process. [9] When temporarily interrupted by injections of an endorphin inhibitor, Wiepkema, et al. found these non-functional behaviors stopped and were replaced by functional behaviors as the sows again tried to escape from the tethers. They also found that the effect of the inhibiting drug grew weaker the longer the animals had been left to engage in stereotyped behaviors.

Grandin (1988, 1989) suggests that animals that engage in stereotypies for a longer period of time may be growing extra dendrites that imprint the abnormality on the circuitry of the brain. Rats in enriched environments with other rats have more dendritic branching in the visual cortex compared to rats in plain cages. Pigs reared in small, barren pens that engage in excessive belly nosing (a redirected behavior) have increased dendritic branching in the somatosensory cortex, a part of the brain that receives sensory input from the snout. Grandin points out that more dendritic development is not necessarily beneficial. Rats exposed to continuous lighting had greater spine

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[9]. For a discussion of issues surrounding the nature of animal suffering, see Dawkins (1980). For a discussion of animal awareness, see Griffin (1981). For a discussion of animal pain, anxiety, and suffering, see Rowan (1988).

density in the visual cortex, but their retinas were damaged.

In cases of extreme stress, or distress, when all efforts and mechanisms have failed, the tethered or crated sow will exhibit "mourning behavior." In this behavior, she sits perfectly still, with head down or leaning on the stall, and eyes tightly closed (Sambraus, H. and B. Schunke, 1982, cited in Scottish Farm Buildings Investigation Unit, 1986.)

So, by using physical measures of general health and soundness, for example, clinical detection of disease and injury; observations of the animal's behaviors, for example, looking for evidence of redirected or stereotypical activities or helpless behaviors; and by neuroendocrine analysis, it is possible to determine what environmental (including management) factors may cause disease, injury, or distress, all of which reduce welfare. By experimental tests, such as the Pig Park Studies above, scientists can learn which activities are particularly important to the animal and what changes in the production environment relieve these symptoms of poor welfare. Then, this information can be used to attempt to design production environments that are improvements over their predecessors in terms of providing for both the physical and mental well-being of the animal.

A **welfare-compatible production system**, in addition to supporting physiological condition and hygiene, will allow the animal to fulfill basic behaviors with respect to its environment that have been shown to be essential to its mental or psychological health and whose prevention or frustration can lead to distress [and, in extreme cases, danger to the animal (Kilgour 1983)].

This description is in agreement with the recommendations of the Brambell Committee, a technical committee appointed by the British Government in 1965 to look into close confinement, intensive farming practices in the United Kingdom. The Committee (1965) recommended that production systems should allow animals at least these five basic freedoms:

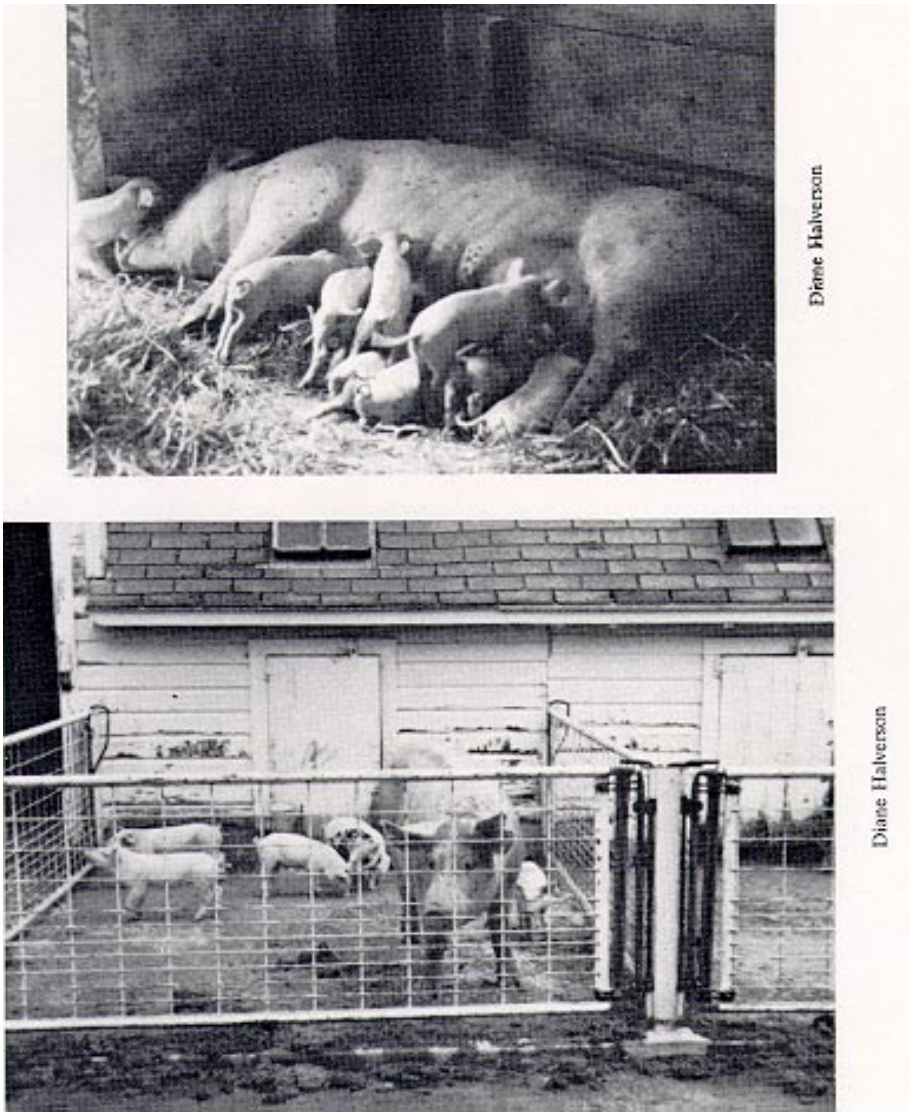
1) to turn around;
2) to groom themselves;
3) to get up;
4) to lie down; and
5) to stretch their limbs.

Moreover, the Brambell Committee stated that it "[i]n principle, disapproved of a degree of confinement which necessarily frustrates most of the major activities which make up an animal's behavior." The Committee further clearly specified that

> the **evaluation of welfare** must consider the scientific evidence available concerning the **feelings** of animals that can be derived from their **structure** and **functions** and also from their **behaviour**.

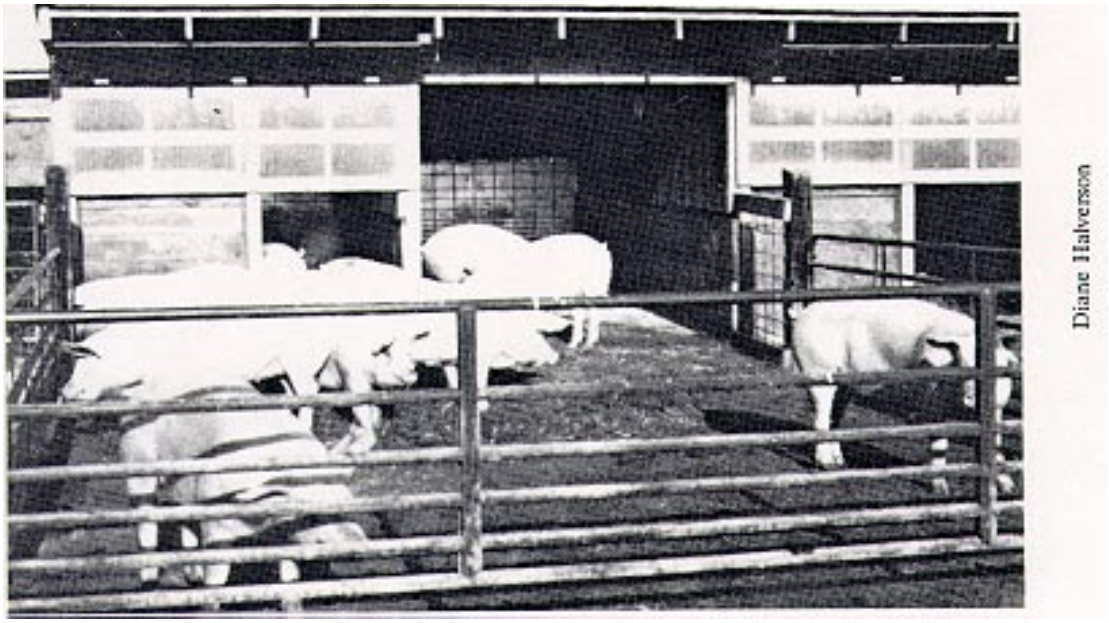
So does this mean we must build forests inside of hog and chicken buildings? Well, no one has ever said so. Does it mean the demise of animal agriculture? Clearly not. The following photographs are of facilities on operating Minnesota farms that already meet the most basic criteria for the welfare of swine. Assuming a high standard of husbandry and management, no adjustments

to production practices would be required to meet accepted welfare standards. [10] The photos below depict welfare-compatible farrowing facilities. The photos on page 22 depict welfare-compatible gestation facilities. On page 23, welfare-compatible boar housing is shown, and on pages 23 and 24, welfare-compatible growing-finishing facilities are shown.

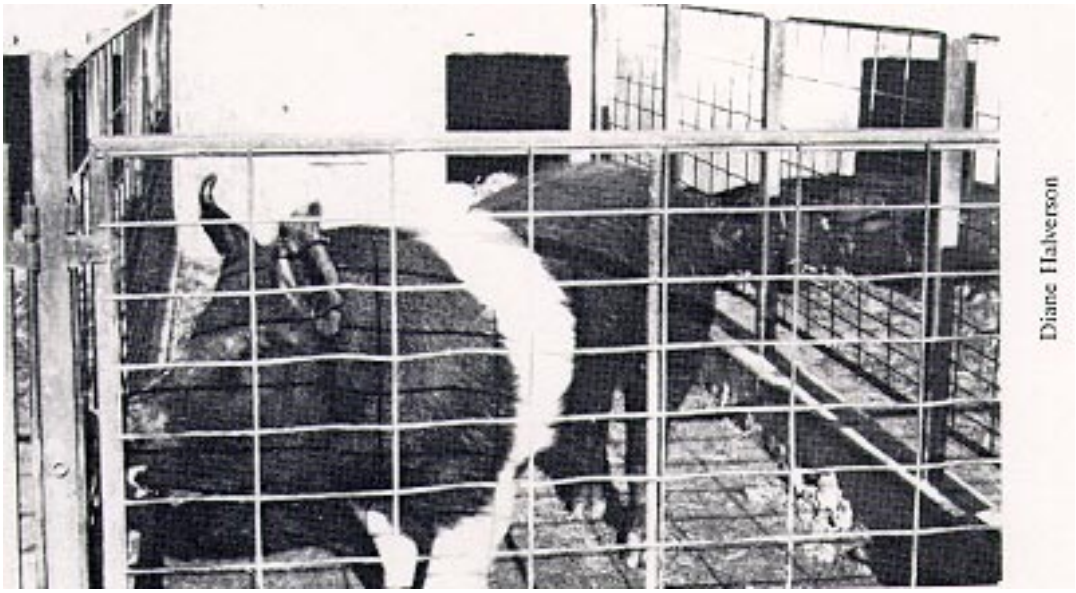


Farrowing Setups With Seasonal Outdoor Access for Sows and Piglets

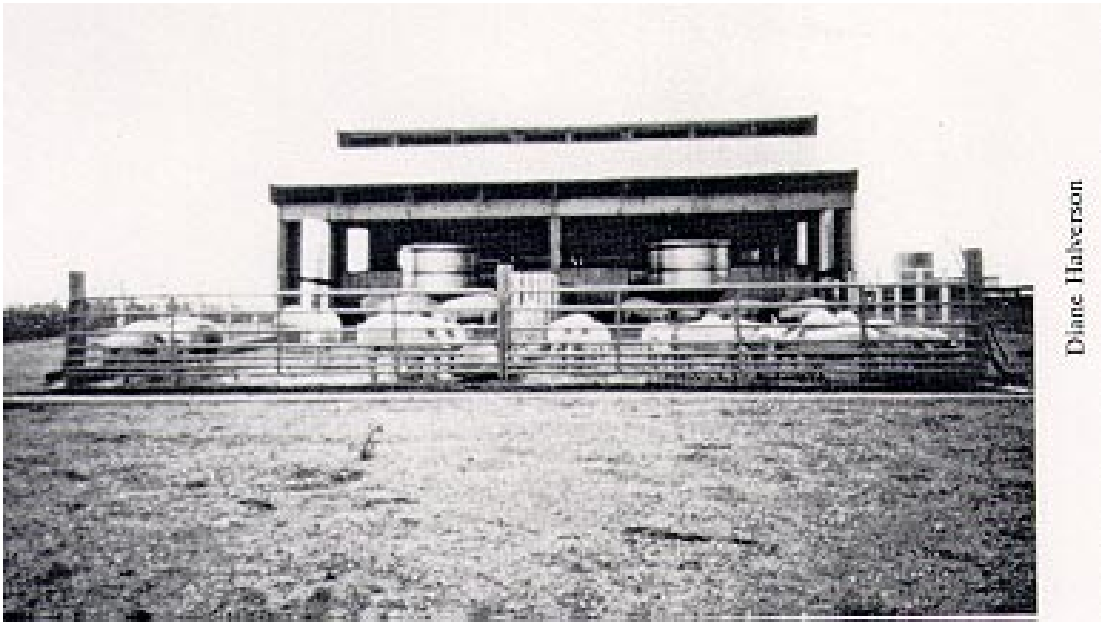
[10]. See Appendices for standards of animal welfare as spelled out in Appendix I: the protocol for farms producing pork for the Pastureland Farms label; in Appendix II: description of rearing practices necessary to qualify for Neuland, a special label for welfare-compatible pork in Germany; and in Appendix III: the Swedish animal welfare statute (with respect to swine).



Gestation
Housing with Outdoor Access



Welfare-Compatible Boar Housing with Outdoor Access



Welfare-Compatible Growing-Finishing Facility, Naturally Ventilated in Summer, Mechanically Ventilated in Winter, with Outdoor Access

Outdoor Access, with Straw, for Growing-Finishing Pigs

The purpose of showing these photos is not to suggest that these production systems represent some "industry standard" for welfare, although each of them meets welfare standards by providing adequate space for freedom of movement, adequate shelter and bedding for comfort and for sound health and hygiene, opportunities for occupation (presence of straw) and social interactions. Rather, the purpose of showing them here is to point out that many existing swine farms would not need to make expensive adjustments to conform to standards proposed by welfare groups. The owner-operators of these farms have used their own experience and knowledge to design systems that are cost-effective, convenient for them, and still supportive of their animals' well-being. The economics of a number of alternative systems are analyzed in Carnell (1983).

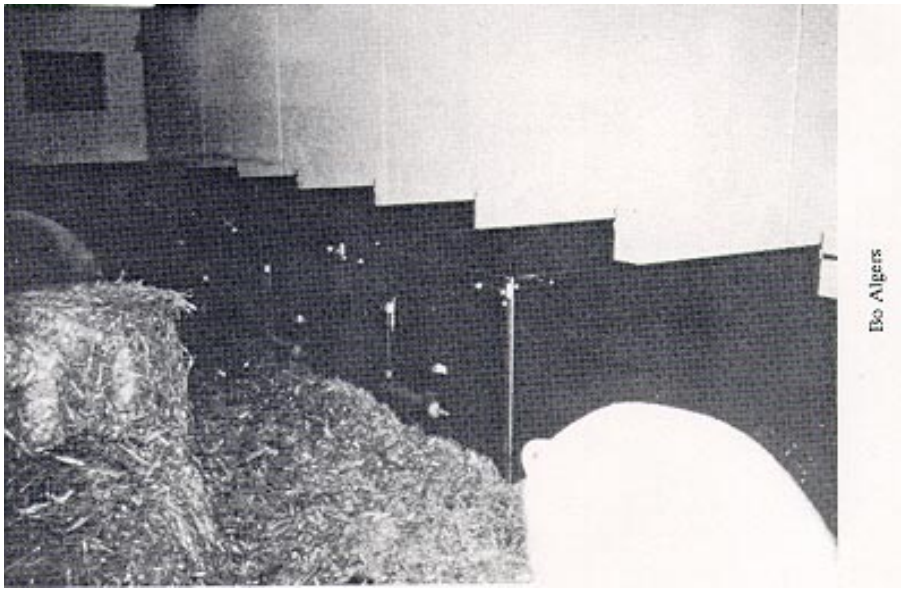
It is possible, however, to take explicit advantage of the scientific results concerning animals' behaviors and their connection to welfare and use that knowledge to design a profitable, welfare-compatible system. In such a system, modern technologies will be combined with knowledge of animal health and behavior to make the most efficient use of labor, management, other variable inputs, and space, within the constraints imposed by meeting welfare objectives. Such systems are under development in Scandinavia, Western Europe, and Canada. Two systems will be described in this and the next section.

The Thorstensson System

Using some results concerning sow behavior from the Swedish Pig Park experiments, Bo Algers, a veterinary ethologist at Swedish University of Agricultural Sciences, and farmers Goran and Kirsten Thorstensson have been developing a welfare-compatible farrow-to-feeder-pig system (Algers 1990).

Gestation Room for Pregnant Sows and Gilts

In this system, gestating sows are kept in a large straw-filled room inside an insulated building. Individual waterers with elevated, automatic feeding stations are provided. Farrowing times are staggered among groups of 15 sows each. About a week away from their farrowing times, the 15 pregnant sows are moved to an adjacent farrowing room that has several large bales of straw in the middle of the room and individual pens, or cubicles, with removable fronts set up along the walls of the room.



Farrowing Room With Temporary Individual Pens

Sows each choose one of these cubicles and, using straw already in the cubicles together with straw they bring from the center of the room, they build their nests in them. Each cubicle door has a threshhold with a roller on top which protects the sow's udder as she goes in and out. Each evening the stockperson checks to see which sows will farrow in the night. If a sow is likely to farrow in the night, the stockperson locks her in her cubicle overnight. Once the sow has farrowed, the cubicle door is opened. While the sows can go in and out of the cubicles to socialize and eat, the piglets stay in their cubicles for the first week. After the first week, the fronts of the cubicles are removed and all the sows and litters are allowed to mix.

Stockperson Removing Fronts of Cubicles

The sows are removed from the farrowing room in the fifth week in order to wean the piglets, who then stay in the farrowing room until they are sold as fatteners. After the sale, the soiled straw is removed and new straw is brought in for the next group of sows. The manure/straw mixture is spread on the Thorstensson's 250 acres and on 250 acres of nearby land.

Although the gestation/farrowing building is unheated, it is insulated, and is mechanically ventilated. However, ventilation is adjusted so that air is circulated at low wind speeds and there is no noise from the ventilators (Algers and Jensen (1985) found that continuous loud noise can disrupt the communication between piglets and the sow that stimulates milk letdown). Windows provide the inside of the building with natural light. There is no outdoor access, although this could be provided.

Day-to-day labor in the system consists of management to detect estrus and farrowing times, to detect problems of the pigs or with the equipment, to add straw as needed, and to maintain human interaction with the pigs. About half the labor time is spent in interaction with the pigs. This daily

interaction consists of observation and stroking.

The producers use antibiotics only when therapeutic use is indicated. However, overall incidence of disease is lower than in conventional systems. For example, incidence of MMA is close to zero with no preventive use of oxytocin. Algers and the producers attribute the low disease incidence to excellent air quality in the building, consistent and humane interaction with the pigs, and the presence of straw.

Piglets Grow to Fattening Weight in Farrowing Room

The Thorstensson system's current average is 21.5 pigs weaned per sow per year (about 22.9 pigs born per sow) and growth rate is comparable to that in conventional systems. The average pigs weaned per sow per year figure in conventional Swedish systems is 18.5. Note that 22 pigs weaned per sow per year is approximately the top level of production consistently achieved in an intensive U.S. close confinement swine system, while the average is about 16-18 pigs weaned per sow per year. These figures are achieved by early weaning (approximately 3 weeks after farrowing) to increase litters per sow per year. [11] Welfare-oriented systems require longer weaning periods -- up to six weeks. The Thorstenssons wean their pigs at five weeks. [12]

At first look, the Thorstensson system may appear simply to be a return to the old, labor-

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11. Compare a six-year average (1982-89) of 19.3 pigs weaned per sow per year for the highest producing Minnesota Farm Business Management farm with central farrowing house and liquid waste management (intensive production) (Lazarus, personal communication). Allowing for differences between Swedish and U.S. calculation methods (see endnote 12, below) by adding 1.5 pigs, this comes to 20.8 pigs weaned per sow per year. Note that this is not intended to be a particularly rigorous comparison. If a more rigorous comparison were intended, we would have to control more variables, for example, be certain that sows and boars in the systems being compared were of the same genotypes, received the same kinds and amounts of feeds, etc.

12. Swedish figures for pigs per sow per year are typically calculated from when gilts are farrowing for the first time. Pigs per sow per year measures are typically calculated in the U.S. from when gilts are bred for the first time. This results in a 1-2 pigs per sow per year and about a .2 litters per sow per year higher figure for Swedish production, assuming systems being compared have the same number of days between farrowings, due to the differences in how these figures are calculated in each country.

intensive production methods of 25-30 years ago. However, the system is designed to make use of important behavioral results to improve management efficiency and productivity, as well as welfare of the animals. For example, milk letdown in sows is facilitated in the system by ensuring there is no ventilation noise to interrupt communication between sows and piglets at nursing time. Also, stocking density in the pens is arranged to accomodate pigs' natural tendencies to establish a dominance order in groups. A dominance order can be achieved either by fighting or by avoidance of fighting. Fighting may be prevented by isolating animals in individual stalls but, as we have seen, for animals that are physically, socially, and mentally active, this can result in distress. If stocking density in a group pen is such that pigs can face each other with sufficient distance between them, a social hierarchy can be established by avoidance of fighting (Fraser 1988). At this distance, the submissive pig can signal its submissiveness to the dominant pig by turning aside, thus avoiding a fight. Order is established by the pigs themselves with minimal stress and without intervention by the stockperson.

This production system was designed specifically to build on the husbandry knowledge and skills of the producers. As the producers' knowledge and experience with their animals grow, so does their human capital of management efficiency and capability.

Currently, there are 85 sows in this system. The Thorstensson's are converting their original facilities, which hold another 85 sows, to the new system, to take advantage of its improved production results, lower disease incidence, better air quality and working environment, and lower labor requirements.

Implications: Welfare and Productive Performance

Let's recall the Pro-Farmer article we discussed earlier. It contained the following assertions:

> There is no better indicator of 'humane' treatment than maximum productivity and efficiency. How could 'mistreated' animals reproduce better or grow faster than 'humanely' treated ones?

We have already discussed the inadequacy of quantitative performance measures for proving 'humaneness' of treatment. But let's assume for a moment that productive performance is sufficient to indicate humane treatment. The second sentence implies that animals in conventional production systems "reproduce better" and "grow faster" than animals in systems that are designed to incorporate specific welfare parameters. As our productivity measure, let's take reproductive performance of sows. Let's start by putting the word "maximum" in quotes, because it is really impossible to define what a maximum or optimum is in the absence of knowing what the production conditions or the capability of the sow are. Each of these will vary across farms and across genotypes. So really, maximum, as an absolute term, should be replaced by some relative term. However, the assertion implies an absolute measure is possible and that conventional systems are achieving it.

Assume, as the quote implies, we can identify a "biological" maximum (for that is what it would have to be to indicate welfare status). The most general "biological maximum" criterion we could probably define would be the most possible litters a sow could have in a year, since litters per sow per year will be less dependent on genotype than a criterion such as pigs born (or pigs weaned) per sow per year. The assertion is that intensive confinement systems achieve such a maximum.

Litters per sow per year for herds in well-managed intensive U.S. confinement systems average about 1.9. Exceptional farms may reach a high figure of about 2.4. These numbers are achieved by early and abrupt piglet weaning at about three weeks of age.

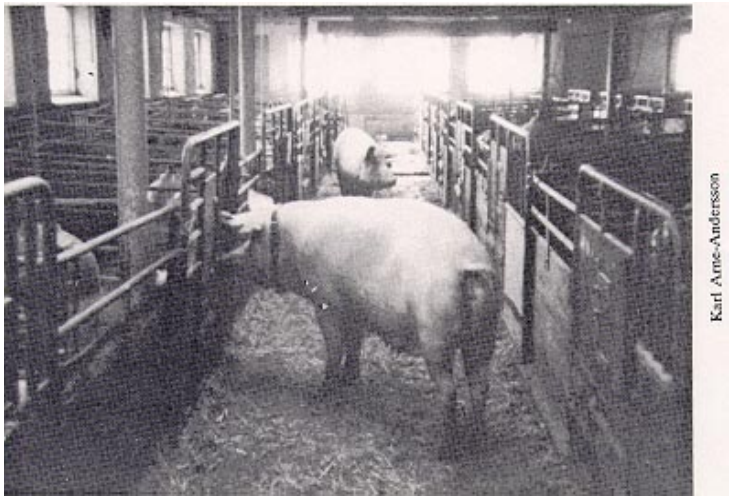
It was shown by Wood-Gush and Stolba (above) that in a semi-natural environment in which domesticated pigs -- sows, boars, and gilts -- were able to interact freely, sows synchronized estrus and also experienced estrus during lactation, about three weeks after farrowing. Since boars were present, sows were bred at this time. In such an environment, litters per sow per year theoretically could reach a biological maximum of about 2.75. Wood-Gush and Stolba developed an experimental Pig Family Pen using observations from the Pig Park experiments. Because estrus occurred naturally during lactation, sows could be bred during the nursing period and litters per sow per year averaged about 2.2 to 2.3.

The Andersson System

We now know that by providing in the production environment those elements for welfare that we have already identified, in the right combinations, with excellent husbandry and pig management practices, it actually **is** possible to produce more litters per sow per year than when only the parameters for physical health are attended to. The commercial possibility of this was demonstrated by Karl-Arne Andersson, a Swedish hog farmer, who designed his own production system to give more autonomy to his pigs and to lower his labor requirements (Halverson 1990).

Andersson's results were verified by three years of research on his farm conducted by scientists from the Swedish University of Agricultural Sciences (Loven and Stalfelt 1987; Hakansson, et al. 1989; Ogle and Bell, 1989).

Andersson started experimenting with his system in 1984 using a special farrowing pen gate of his own design that would allow his sows to leave their individual farrowing pens and mingle with other pigs in the system, while the piglets stayed behind in the pens until weaning. In Andersson's system, nursing and pregnant sows, pregnant gilts, and boars had access to both the gestation and farrowing buildings and could mix freely with one another. A computerized transponder feeding system with two feeding stations allowed animals to feed at any time during the day up to an individually determined maximum daily allotment. Estrus occurred during lactation, usually about 21 days after farrowing. Since the boars were always present with the sows, breeding occurred at this time.



Sow in Dunging Alley Outside Farrowing Pens,
Andersson Farm, Orsundsbro, Sweden

Andersson's herd averages of litters per sow per year were 2.47 in 1986; 2.54 in 1987; and 2.5 in 1988. Percent of sows showing heat during lactation for these years averaged 43% (in spring 1986, 78% of sows showed heat during lactation but only 7% showed heat during lactation in fall 1986), 59%, and 49%, respectively. Sows that showed heat during lactation were bred between 21 and 25 days of farrowing and averaged about 2.7 litters per year; sows that did not show heat during lactation were bred about 42 days after farrowing and had an average of 2.34 litters per year. Average pigs weaned per sow per year (figured by multiplying litters per sow per year times average litter size) were 26.3 in 1986, 28.2 in 1987, and 24.6 in 1988, giving a three-year average of 26.4 pigs weaned per sow per year for the three year period.

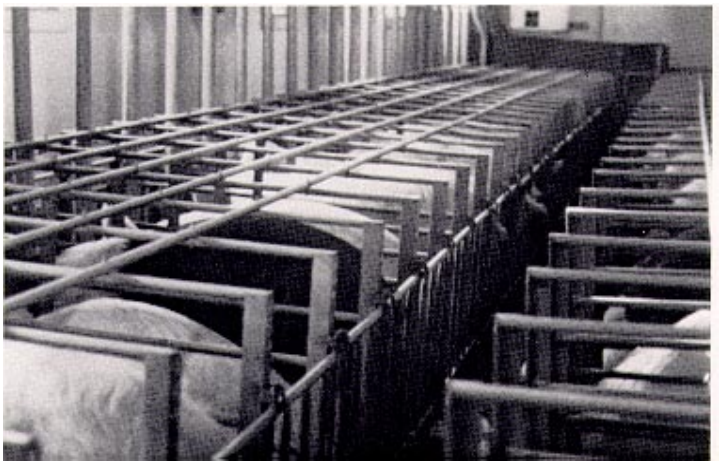
Since breeding occurred during lactation, piglets were weaned gradually. Piglets had access to creep feed, and sows generally initiated the weaning process themselves by staying away from the pens for successively longer periods of time. Final weaning occurred at 5 weeks of age. Andersson used no antibiotics in his feed (this use became prohibited by law a couple of years after

he started his system) and, since he raised his own replacement gilts, he did not find it necessary to vaccinate. Because they were able to exercise, Andersson's sows stayed in good physical condition; he was able to keep them longer and take advantage of increased numbers of pigs born per litter as sows matured. There were no negative effects to the sows of breeding during lactation. However, if estrus is shown too soon, a reduced litter size will result. In one observational study conducted by Swedish University of Agriculture, sows that showed heat before 21 days after farrowing had an average of 11.3 pigs born live compared to an average of 12.1 pigs born live for the rest of the sows in the group.

Andersson retired in 1990 but, while it was in operation, from 1984 to 1990, his system exceeded the requirements of the Swedish farm animal protection statutes which were not enacted until 1988. Andersson used straw bedding and composted manure before spreading and did not find it difficult to meet strict Swedish environmental rules.

Andersson With His Patented Farrowing Pen Gate

Andersson's results were outstanding, even by Swedish standards. However, the question arises if, by carefully employing technology and husbandry techniques in a manner compatible with total welfare it is possible to produce more litters and more pigs per sow per year than in conventional systems, to what standard of "maximum" performance could the Pro-Farmer article be referring?



Intensive Confinement Gestation Unit with Individual Sow Stalls

Tier Decks for Weaned Pigs

In roughly the same building space where Andersson would put 30 farrowing pens, 30 gestation pens, and five boar pens, a conventional, intensive confinement producer would put over twice the number of farrowing crates, twice the number of gestation crates, and twice the number of boar crates. He or she might get fewer pigs and litters per sow per year, but his or her output of pigs weaned **per building** per year -- a kind of **spatial** measure of productive performance, if you will -- would be higher than Andersson's biological measure of productive performance.

Focusing on the spatial optimum, producers focus on output per unit of capital input or investment; focusing on biological optima, producers must concentrate on the output of the individual pigs. Producer attention to welfare aspects of production improves the possibility for a high sow productivity by providing careful management and an environment that is compatible with both physiological and psychological health parameters. Lower productivity per sow in space-intensive confinement systems is masked by the higher output per unit of space. A spatial measure of productivity cannot indicate welfare.

Implications: Welfare and Economic Organization of Farming

Given the high cost of investment in total confinement facilities, firms that use them must restrict both the space allotted and the human attention paid to each animal and maximize overall output to keep average costs low enough to stay profitable. By these means, economies of scale can be attained in capital- and space-intensive systems. [13] Although some of the tax policies and practices described (endnote 13) have been changed, small, mid-sized, and larger independent producers (ranging from "typical to leading" enterprises, in the terminology of Van Arsdall and Gilliam 1979), still face serious competition from high-volume, specialized hog operations ("exceptional" firms in the terminology of Van Arsdall and Gilliam) with respect to their average costs of production, or total costs spread over output. [14] (See also Van Arsdall and Nelson (1985).)

By generally favoring diversified farms with smaller populations of livestock, could welfare-compatible production prove to be a savior of small and mid-sized production units? In the short-term, possibly yes. For the long-term, the current economic and political-economic incentive structures in the livestock industry (endnote 13) make it very difficult for **any** independent hog producer to stay in hog production.

How could this be so? Every production technology has associated with it a minimum efficient scale (MES) of operation, i.e., an output level up to which added size (of capital investment) brings added efficiency and beyond which size conveys no additional advantages (Greer 1984) and, we might add, in the absence of diseconomies of scale, no disadvantages are conveyed either. Up to the MES, average cost of production associated with the same technology at consecutively larger output levels (sizes of operation) decreases rapidly and levels off after the MES

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13. The emphasis on unit cost efficiencies per farm size or scale as opposed to production or output efficiencies is an extension of the economy of plant size concept for non-farm industries. Some forms of agriculture, such as animal production, are amenable to the plant type of structure, although, as we have seen, not without costs to the animals. Technology (including both "hardware" and antibiotics for administration at subtherapeutic levels) and genetic selection have enabled concentration of production in the turkey, broiler and laying hen, hog, and increasingly, the dairy and beef industries, and have reduced the need for land and space still critical to crop agriculture.

    Certain political-economic incentives have tended to reinforce adoption of space intensive technologies. They include government price support programs that have made farmland more profitable for growing crops than for raising animals (Penn 1979); tax policies of the 70's and early 80's such as investment tax credits and rapid depreciation on confinement facilities, writeoffs of capital investments as cash expenses, inclusion of closely held large corporations in the definition of family farms eligible to use cash accounting; and capital gains exemptions on sales of breeding stock that removed the economic penalty associated with quick sow turnover. In addition, use of space intensive, close confinement operations is supported by the option to use subtherapeutic levels of antibiotics in animal feeds to help suppress clinical manifestations of disease in stressful, crowded environments and increase growth rates and flow-through rate of animals.

14. Small, mid-sized, large, and giant are terms that have changed both absolutely and relatively over the past two decades as economies of scale have increased. In 1979, Van Arsdall and Gilliam characterized hog enterprises as: typical (650 head of slaughter hogs sold annually, with three enterprises, corn, soybeans, and hogs); leading (more highly capitalized than the typical farm, with sales of 5,000 head annually and with all crops used for feed; and exceptional (reaching factor specialization levels beyond those of the leading farm, usually characterized by some form of vertical or horizontal integration, marketing about 250,000 hogs annually). In 1990, the typical farm of 1979 is no longer typical. Typical farms now are characterized by sales of 1,000 to 5,000 hogs annually, while exceptional firms sell above 300,000 hogs annually.

is reached.

It is assumed that at very large firm sizes for a given technology, diseconomies set in and the long-run average cost curve starts to bend upward. These diseconomies might be the high costs of disposing of manure, medical wastes, and/or hog carcasses; of odor prevention; of worker health and safety; or, simply the difficulties of managing the operations at larger sizes. To the extent that these problems are dealt with by the firm itself, they will raise the firm's costs. To the extent they are not dealt with by the firm itself, they result, in the words of economic theory, in externalities, or costs displaced by the firm onto society. Society's costs may consist of (but not be limited to) higher taxes to clean up water pollution caused by manure runoff; health problems due to nitrate pollution of groundwater supplies; loss of amenities if odor from neighboring hog operations is a problem; and growing antibiotic resistance of salmonella and other bacteria resulting from routine nontherapeutic use of antibiotics as growth promotants and disease suppressors in densely populated production environments (Cohen and Tauxe, 1986; Holmberg, et al. 1984; Tauxe 1986).

If such diseconomies exist but are externalized to society by the firm or subsidized by government programs, exceptional firms can establish themselves and grow, contributing their large output volumes to supply. If the shift in output is large enough and there is no concomitant shift in demand, output price falls. Output price may fall below the average cost of producers who have adopted the same technology but at scales too small to be profitable under the new market conditions. Lower prices will benefit consumers only if they are not also paying for this lower cost output with increased risks to health, resource depletion or contamination, or with higher taxes for other externalities.

If the scale efficiencies of the exceptional, highly specialized enterprises are great enough, and output volumes are high enough, average costs of production for exceptional operations also **may** fall below average costs for producers using less capital-intensive production technologies. As a result of stable demand, output prices **may** also fall below the average costs of producers using less capital-intensive technologies. When this occurs, producers who are unable to continue as independent producers, may contract their facilities and services to investors or to larger operators, or they simply may choose to get out of the business.

Yeboah and Heady (1984) and Paul (1974) found evidence that increased specialization of production decreases elasticity of supply over time. Specialization and capitalization tend to decrease firms' flexibility of entry and exit. Producers who leave hog production tend to be the smaller, less specialized, and less-capitalized producers who can reallocate their investment to their other farm enterprises. Producers who stay in tend to expand production to fill the space left by exiting producers.

But it is the smaller producers with diversified farming operations that tend to keep animal numbers to levels that can enable their enterprises to be both environment- and welfare-compatible, so long as market pressures (increasing factor costs and decreasing output prices) do not force them to compromise environmental and husbandry standards. [15]

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[15]. This is the rationale behind some of the special label programs for welfare-compatible pork products. The protocol for Pastureland Farms pork products, a special label initiated by the Animal Welfare Institute, specifies that farms enrolled in its program should be family farms, i.e., where families own the farms and the

While welfare-compatible production systems may improve production results for independent smaller producers and give them staying power in the short run, in the absence of some change in the political-economic incentives characterizing U.S. agriculture, the prevailing competitive edge is with expanding operations maximizing output per unit of capital investment. In the long run, competition from exceptional firms may reduce the production opportunities, not only for farmers who would like to provide for the total welfare of their animals, but for all independent producers whose operations range from typical to leading. [16]

Niche Market Opportunities and Obstacles

Many existing farms producing hogs already meet the basic welfare criteria with few or no adjustments. In the absence of the types of policy changes noted in endnote 16, the development of niche markets for these small and mid-sized producers may help them continue to raise hogs and sell their product under a special label indicating that their product was produced under welfare-compatible conditions. Some producers have been able to do this in the laying hen and veal calf industries. Humane Farming Association and Food Animal Concerns Trust assist producers with marketing special label veal and eggs. Recently, the Animal Welfare Institute test-marketed a special label pork product from a Minnesota farm, under the name Pastureland Farms.

Special label products must meet strict U.S. Department of Agriculture guidelines to ensure that what is on the label is what is in the package. This means that animals whose meat is destined for these labels must be slaughtered and processed separately from other animals. Given the extra effort and expense of separate slaughter and processing together with uncertainty about the extent of consumer demand for these products, large packers and processors understandably do not want to take a chance on them. Logically, small packers and processors could fit the need nicely. But, it is also becoming difficult for small processors to compete in the prevailing economic climate. In the slaughter/processing industry, as with large hog production plants, high fixed costs lead packers and processors to lower their average costs by increasing kill rates (per hour and per worker) and flow-through of hogs. The drive to minimize costs makes the price competition among large packers for hogs fierce. Offering producers the option to sell on a grade and yield basis and receive

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hogs, and where each family depends on the farm for its livelihood and provides the major part of labor for the farm operation. The protocol for a special label pork product in Germany, Neuland, also requires that producers in its program be family farms and goes one step further, limiting pig numbers on the farm to 60 sows plus their piglets and a maximum of 300 fattening hogs. This requirement is as much to meet environmental quality concerns as to meet welfare concerns. See Appendices I and II for general descriptions of these two protocols.

[16]. One adjustment to the political-economic incentive structure that was suggested by the Center for Rural Affairs a few years ago involves decoupling price supports from production goals and recoupling them to positive producer efforts to meet various social goals. These might include protection of wetlands and groundwater, human health, and animal welfare. By moving the focus of government support away from intensive production, such policy adjustments may help to level the playing field for smaller, independent producers. The link between the loss of family farms and farm support programs tied to production was detailed in U.S. Congress (1986). Another way of leveling the playing field is to put realistic prices on scarce public resources that are used for private use. For example, one "exceptional" size hog firm, having bought up water rights from neighbors, is estimated to use over 2 million gallons of fresh groundwater per day to flush swine barns of manure. A price on water rights that reflects not only water's value in current use but its value to future generations, or a change in the rules regarding transfer of water rights could eliminate this pecuniary scale economy.

a premium for their hogs if they meet high standards for leanness and carcass quality, helps improve a packers' competitive position in hog procurement relative to packers who do not offer such options, for example. Small packers generally do not.

Producers of generic pork products simply sell their hogs to the nearest slaughter plant. Producers who want to differentiate their products and sell them under a special label must find a U.S. Department of Agriculture inspected slaughter plant that is able to keep their product distinct. This will usually be a smaller plant where the plant operator must charge for the slaughtering and processing. This adds to the cost of selling a special product.

Special labels must be prepared and the label content must be approved by the U.S. Department of Agriculture. A retailer must be found to take the product or, alternatively, a distributor must be commissioned to purchase the product and sell it to retailers with whom it does business. An extra problem arises in that few niche market distributors exist that are both experienced with specialized needs of meat product distribution and willing to take on the additional responsibility of marketing separate products coming from a small number of producers. Fresh meat is highly perishable and a single carcass yields many different cuts. Frequently the stores and restaurants carrying special label items are interested only in certain cuts -- for example, loins and ribs -- for which consumers are willing to pay a premium price. Then the problem arises of where to market the rest of the carcass and the offal. These must be sold either to specialty processors and retailers, usually for a premium, or in the regular market at the going market price. The premium on the special cuts and specialty products must be sufficiently high to compensate for these extra costs of bringing the product to market. In turn, the quality of the product must be exceptionally high compared to generic products before consumers will pay the higher price.

Ideally, a complete marketing program, including advertising, would be in place in advance of when the product goes to market. In reality, however, things don't always operate smoothly. Many things can happen to disrupt the schedule. The label preparation and approval process can take longer than expected, for example. At the retailer's level, the quality and attractiveness of the product depends on the care it receives in preparation and display. Employees may not share the retail establishment's commitment to the product. In such a case, the success of the product is at risk. All fresh food items are vulnerable at all the stages along the way from production to sale. Competition for shelfspace at the retail level is high. Producers of a special label fresh product are particularly vulnerable because the product may not generate the profit per foot of counterspace or worker hour that higher volume meats do.

Welfare-oriented meat products have been perceived by many in the animal agriculture industry to be directly competitive with generic fresh meat products since they are differentiated on the basis of production method and quality. These perceptions by the industry add to the vulnerability of welfare-oriented special label products. Pork industry associations have not overwhelmingly supported efforts by individual producers to offer such a differentiated fresh pork product to consumers (see for example, comments by a pork industry official in Fowler 1990). In some cases, extremists in the industry actively misrepresent the products or the programs to agricultural audiences (see Kopperud 1990, for a particularly illustrative example of misrepresentation concerning the Pastureland Farms project of AWI, appearing in the Animal Industry Foundation newsletter under the caption "Reality Intervenes in Minnesota So-Called

'Humane Pork Project'" [17]). In other cases, they warn there is no common ground (Kopperud

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[17]. The following news item appeared in the Animal Industry Foundation Newsletter of November 13, 1990 under the headline "Reality Intervenes in Minnesota So-Called 'Humane Pork Project:'"

> According to reports, the so-called 'humane pork project' sponsored on a Minnesota farm by Christine Stevens' Animal Welfare Institute has died a quiet death. Fundamental to the demise of the project was that AWI's assurance that 'humanely' produced pork, i.e., pork from European style 'family' production units, would bring a higher price simply didn't materialize. Other pork producers in the state were also critical of the system, and some reported that mortality was expectedly high in the open system. The Minneapolis supermarket pulled the products for lack of consumer interest in the higher prices, and the $.75 - $1.25 premium the farmers were promised never happened. Loins reportedly sold, but not other cuts. All-in-all, the farmers took a one-third cut from prices they would have received from the local commercial packing plant (Kopperud 1990).

Having been involved in an informal capacity as an advisor to this pilot program, I think it is important to point out how the Pastureland Farms program is misrepresented in this article.

First, the point should be made that the Pastureland Farms program was a pilot project designed to test market pork from a farm that was already in operation, with facilities similar to those of many midwestern family farms producing hogs. A staff member of the Animal Welfare Institute was introduced to the producers and, seeing that they and their farm met the Institute's criteria for welfare-compatible production, asked them if they would like to join the Institute in test marketing a pork product from their farm under a special label. The producers agreed, and a protocol was designed around the farm's existing production system.

Pastureland Farms pork was not, as stated in the article, produced in "European style 'family' production units." As accurately reported by other writers: Pork '90 (Miller), The Farmer (Ritter), Hogs Today (Lamp), and The New Farm (Cramer), the producers in question were experienced hog producers. For the program they used the same facilities that their uncle, a top Minnesota producer of purebred Poland Chinas, had used for many years prior to his retirement. On this farm, sows farrowed in 8 by 8 foot straw-bedded pens in a central farrowing house, weaned pigs were raised in an outdoor nursery in summer and an indoor nursery in the winter, finishing pigs were raised on pasture in the summer and in a converted dairy barn with an outside lot in the winter, and gestating sows were housed in bedded shelters on pasture. As the producers emphasized in these articles, they were producing as they would have produced, even without the Pastureland Farms program.

There were no "European 'family' style production units" and no "open system" on this farm or associated with the Pastureland Farms program, nor was there high mortality. The article's claim that "other producers in the state were also critical of the system and some reported that mortality was expectedly high in the open system" is incorrect.

The retailer and the restaurant where the Pastureland Farms products were sold ordered only loins and ribs. It was for this reason and not for lack of consumer response that only loins and ribs sold under the program. The rest of the meat was sold in the regular market. (An average of 10 hogs per week from this farm was test-marketed under the Pastureland Farms label.) Moreover, consumer demand was high enough for the fresh loins and ribs that the retailer requested that bacon, smoked ham, and sausage products be developed. These products had been developed and the retailer had scheduled in-store demonstrations of the new products when, two weeks prior to the scheduled demonstrations, the retailer unexpectedly cancelled its participation in the program.

The extent of consumer interest in the Pastureland Farms pork product is far from clear. Inconsistency in product handling and recordkeeping at the retail level made a rigorous demand analysis impossible. (To cite only two examples, a representative of the retailer reported that a large portion of the sales records for the program were lost and, for a part of the testing period, the product was placed in a store located in a neighborhood where a large proportion of the residents do not eat pork due to religious beliefs.) These

1989); advise farmers against "compromising" or cooperating with welfare groups (Smith 1990); and pay only passing attention to the disparate goals of animal rights and animal welfare associations in dismissing the concerns of both (Gunderson 1990). Contrast these extreme views with those in Pijoan (1988), Halverson (1989), Friend (1990), Rollin (1990), Getz and Baker (1990), and Hartsock and Gallagher (1990).

Common Ground

If it is the case that some farmers may benefit from adopting systems that lower some of their production costs and improve their animals' productivity through facilities design and management, and if it is the case that some farmers may be able to obtain a higher price for their product by selling products for which some consumers have indicated a preference, there can be no justification for keeping this kind of information from them or implying that if they seek such a road they somehow are compromising the future of all of agriculture. The freedom to choose these alternatives is part of the bedrock on which a free market economy rests. Rather than ridiculing the efforts of welfare associations to establish a common ground, we might consider the alternative of welcoming these efforts and even reaching out to help facilitate them where possible. Certainly we cannot claim that current production practices are the best we can do or the only way to produce.

This is important, I believe, because we in agriculture stand to lose by our industry's continued focus on extremes and refusal to seek common ground. [18] We lose when we increase consumers' perceptions that agriculture does not recognize and/or is not responsive to their concerns,

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circumstances, coupled with the fact that the retailer requested that the product not be advertised, make it difficult to draw sound conclusions about consumer response to this product or to predict consumer response to welfare-oriented pork products in general. However, up to the time the program was discontinued, the retailer continued to assure project leaders that it was committed to the program and that sales were "more than satisfactory."

The Pastureland Farms test program lasted approximately 7 months, from October 1989 through April 1990. As an interim measure, until the market could be fully developed and made secure and all the products (besides the fresh loins and ribs for which the producers were already receiving a premium price from the retailer) could be developed so that a premium on all products could be paid directly to the producer, the Animal Welfare Institute absorbed the extra costs associated with the test marketing program. The Institute also paid the producers a generous premium on each hog, over and above the grade and yield premiums the producers would have received from their regular packer. The article's assertion that "all-in-all, the farmers took a one-third cut from prices they would have received from the local commercial packing plant" has no factual basis.

Finally, the Pastureland Farms program has not "died a quiet death." Those involved remain optimistic about the program. It now is being restructured using the experience gained from the pilot effort.

This newsletter item illustrates a general tendency by extremists on **both** sides of the welfare issue to serve their own interests by playing fast and loose with the truth. Misrepresentation, if used deliberately, can be an effective tactic if one's audience does not have access to the information, the time to check the information for accuracy, or if attitudes already have been formed and misinformation can be geared to reinforce them. If by representing misinformation as information, dialogue and cooperation can be prevented, the facts may never be heard.

[18]. This same unfortunate, all-or-nothing approach characterizes the debate about the use of animals in experimental research. Here, too, the opportunity to establish a middle ground is missed. See, for example, the Animal Welfare Institute's handbook Comfortable Quarters for Laboratory Animals. Appendix IV contains the introduction and policy statement of the Institute reprinted from this handbook.

and that agriculture is unwilling to provide a product for which many have indicated a preference. We risk the possibility that the public **will** choose between one extreme or the other and that that choice will be a drastically reduced level of meat consumption. Happily, extremism does not characterize the views of everyone in agriculture. Getz and Baker (1990:3474) point out, for example, that animal rights and animal welfare groups "ultimately may improve animal agriculture because challenging current methods, procedures, and assumptions usually leads to improvement."

By continuing to focus on extremes we also waste precious time and resources. By denying scientific evidence that indicates animals' abilities to adjust are taxed heavily by current agricultural practices (Van Putten 1988), we miss opportunities to expand our knowledge base and improve animal production. Again, we lose. The science of animal welfare adds to the scientific study of animal life the mental or psychological dimension of health and hygiene. In doing so, it offers the possibility of extending our ability to evaluate total animal welfare considerably beyond that afforded by the old Newtonian-Cartesian paradigm that viewed animals as "natural automata" whose total welfare was determinable by physiological measures alone. [19] There is much to be learned about animal management under the new regimes before some producers will be able to adapt successfully to them. In environments that give the animal more control over its activities, skilled management is critical. In the U.S., we are far behind institutions in other developed countries in both basic and applied farm animal welfare research and in education of producers, veterinarians,

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[19]. It should be noted, however, while the empirical evidence of the behavioral and physiological changes in animals during adjustment to stressful environmental conditions is well-documented and not in dispute, some scientists do question how such evidence should be interpreted. Barnett and Hemsworth (1990) point out that these differences in opinion may result from researchers having been trained in different areas of expertise (e.g., in physiology as opposed to behavior, and vice versa). At issue are such questions as can animals "suffer" and what does animal suffering mean?; at what levels of change (in physiology or behavior) can we properly say welfare is at risk?; do animals think or have conscious self-awareness so that they **care** that they are in pain, and if they do not, do humans have a responsibility to care and to adjust production methods to accomodate what some believe is humans' subjective interpretation of animal needs? (For further discussion on these points, see exchanges between Barnett and Hemsworth 1990; Van Rooijen 1990; Bradshaw 1990; and discussions in Applied Animal Behaviour Science 19(1988):339-386 and Applied Animal Behaviour Science 22(1989):93-225.) We should not stop trying to find answers to these questions, but we should also recognize that the answers to some of them may not be determinable by science. Bradshaw (1990) suggests that the question of whether subjective experience exists in animals is as old as the subject of philosophy itself, and scientifically insoluble. In this case, he says, for applied behavior scientists, whose professional interest is what is best for the animal, acceptance of the assumption that subjective experience in animals exists may be justified simply on the grounds that an assumption that it does not may be wrong.

Although some scientists object to drawing conclusions about animal needs without physiological evidence that damage occurs when they are not met, others state that physiological data can only confirm observations. By themselves they are not sufficient to determine welfare. This, it seems reasonable to conclude, is what the Brambell Committee had in mind, as well, when it stated that scientists must conclude what they can about animal feelings from their structure and function **and** their behaviors. Van Rooijen (1990) illustrates by saying that physics confirmed the existence of atoms long after they were used as a model to explain chemical data. Hughes (in AABS 19(1988):351) suggests that the conclusion that some animal needs may need to be interpreted based on human intuition should not cause problems because, "although an anthropomorphic approach is undesirable in that one should not interpret animal behaviour in terms of human feelings, needs, emotions, and viewpoints,..., it is acceptable to argue that human consciousness has not emerged fully formed from a vacuum. It is much more likely to have arisen through natural selection, which implies some sort of evolutionary continuity between human feelings and those of animals. The connections, of course, become more tenuous the further one travels down the evolutionary scale."

teachers, and researchers. We are even farther behind in production system design based on scientific principles of welfare as fully defined to encompass both physiological and mental health of the animal (see, again, the Brambell Committee recommendations, page 20).

We are mistaken if we believe that social concerns regarding the treatment of animals are going to go away or that they can continue to be answered by denial and resistance. Social judgements regarding the welfare status of animals in agriculture **are and will continue to be** based not only on the findings of science, but on humans' intuitive beliefs regarding the existence of animal consciousness and on humans' increasing willingness to apply a kind of golden rule that extends outside the human sphere to animals. Opportunities exist for finding common ground. Science offers society not one but many paths to a goal and not one but many technologies with which to realize an objective. To choose among them is not to reject the science which produced them all, but is the prerogative of a society in charge of its destiny.

An Animal Welfare-Oriented Structure for Agriculture

Animal agriculture plays and will continue to play an important role in the production of food and other human goods and services. The real question is in what form will it continue? For the reasons just stated, the possibility of adopting a more welfare-oriented structure of animal production within the current political-economic incentive structure in the industry seems limited. However, I would like to put forward the following hypotheses for consideration regarding potential effects on supply, demand, and agricultural sustainability, if it were to happen that the political-economic environment would be adjusted so as to be favorable to the adoption of welfare technologies.

Effect on Supply

A question frequently asked is if we could maintain pork supplies if welfare regulations were to be implemented in pork production. Of course, much depends on the way the rules are formulated. In Sweden, for example, producers were given a period of several years to phase in legal requirements and phase out old production facilities. But including welfare parameters in swine production systems, if it also included focusing on achieving biological productivity optima, and if many small and mid-sized independent producers were able to include this diversifying enterprise on their farms, should not endanger our U.S. supply of pork if the industry is given time to adjust to regulations. (See, also, the conclusions of a 1985 study from the University of Manchester on the potential effects of animal welfare regulations on the structure of the industry in the United Kingdom and on supply (Sandiford 1985).)

Attention to welfare at the slaughter level can increase the amount and improve the quality of meat that gets to the retailer (Moss 1982; Kilgour 1984; Bareham and Vestergaard, in Baldwin, et al.; Grandin 1982, 1983). With the very high levels of stress experienced by meat animals during transport to market and during slaughter, large packing companies such as IBP and Cargill's Excel are beginning to install more welfare-compatible slaughter systems to reduce carcass damage and other losses from "stressed meat." (In swine, pale soft exhudative (PSE) meat is a well-known result of pre-slaughter stress (Kilgour and Dalton 1984). Although PSE meat occurs most often in swine that are genetically susceptible to stress -- those exhibiting what is termed porcine stress syndrome (PSS) -- it also appears in "genetically normal" pigs, i.e., those that do not exhibit this syndrome

(Bresson 1982; Grandin, personal communication, 1990).)

Effect on Demand

For the past three decades, per capita demand for pork has averaged about 60 pounds (high figure 69 pounds, low 51 pounds). This stable average per capita consumption level appears to indicate that consumers prefer that their diets contain a certain percentage of pork (Van Arsdall and Gilliam 1979). Welfare-compatible production technologies by reducing the stress associated with intensive confinement, also reduce the need for routine non-therapeutic use of animal drugs in feed, adding to consumer perceptions of its safety. Consumers also express concern about production animals' welfare and the effects of intensive animal production on the environment.

Given the relatively inelastic demand for pork in the diet and the opportunity to provide a product responsive to consumer preferences, demand for pork may not decrease even if higher prices for this meat should result. In fact, demand for pork may increase somewhat if pork producers were alone among meat producers in adopting welfare- and environment-compatible production technology and providing a product for which some consumers have expressed a preference.

Contributions to Sustainability of Agricultural Systems

A welfare-compatible production system gives animals more control over their own environments by using knowledge of animal behavior to guide husbandry and management by the animal caregivers. Management and natural inputs substitute for mechanized inputs. Mechanized inputs, when used, are designed to conform more closely to animal and human needs.

Observed benefits include healthier environments inside buildings both for the animals who live in them and for the humans who work in them. Animal manures combined with straw add tilth as well as nutrients to the soil. If designed well, with people, the animals, and the environment in mind, welfare-compatible production can be protective of the environment, while being profitable for the producer and providing a plentiful supply of pork.

In short, welfare-compatible livestock production could contribute substantively to the goals often cited for sustainable agriculture: to maintain the natural resource base on which agricultural systems depend; to sustain biological and ecological integrity of the farming system; to maintain profitability and economic self-reliance of the farming operation; and to meet the expectations of the local community and consumers, including a dependable supply of safe, high quality food. This connection between welfare-compatible production and long-term sustainability of agriculture has been made elsewhere (Fox 1988; Honeyman 1990; McMahon 1990). The Humane Society of the United States and the International Alliance for Sustainable Agriculture, in Minnesota, are working with farmers, farm groups and agribusinesses to develop a definition of "humane sustainable agriculture" and the principles to support it.

Moreover, welfare-compatible technologies are transferable to those developing countries where labor is plentiful and training in the advanced husbandry skills for operating welfare-compatible systems can increase the value of human capital in animal production.

Future Directions and Choices

The Pro-Farmer view quoted above points out one of the dilemmas facing agriculture and all of our society about the current directions of food production. It is seen to be emerging in the numerous concerns that are being voiced about sustainability of agriculture, protection of the environment, food safety, the well-being of animals used in food production, the health and safety of workers in both intensive confinement buildings and in slaughter-processing plants, and about both the ethical and safety aspects of the animal biotechnologies. In which measure of productivity shall we, as a society, put faith?

At some point in our history, following World War II, we stood at a crossroads in the development of the animal agriculture industry. There were two routes to go, both grounded in science: a biological-ecological route and a mechanical route.

Concerns about food security following the war, a great confidence in the engineering technologies that had contributed to the Allied victory, and insufficient knowledge regarding biological and behavioral parameters in animal production directed us to the mechanical route. Reinforcing the choice were inherited beliefs pertaining to the meaning of human progress, the nature of the human-animal relationship, and the Cartesian-Newtonian framework, in which the science of the day operated, that denied (and continues to deny) the existence of animals' subjective experience.

Twenty-six years ago, in the United Kingdom, a small book called Animal Machines, authored by Ruth Harrison, created the public outcry that led to the establishment of the Brambell Committee and its report which, in turn, led to the application of the scientific discipline of ethology or animal behavior to the study of farm animals. Writing the foreword to Animal Machines, Rachel Carson, the author of Silent Spring which had been published in the U.S. two years earlier, remarked:

> As a biologist whose special interest lie in the field of ecology, or the relation between living things and their environment, I find it inconceivable that healthy animals can be produced under the artificial and damaging conditions that prevail in these modern factorylike installations, where animals are grown and turned out like so many inanimate objects.... I am glad to see that Ruth Harrison raises the question of how far man has a moral right to go in his domination of other life.... It is my belief that man will never be at peace with his own kind until he has recognized the Schweitzerian ethic that embraces decent consideration for all living creatures -- a true reverence for life.

We have travelled quite a long way down this route where animals are considered little more than mechanical factors of production. The idea of reversing direction and progressing along a different route at this date causes alarm to many. But we in agriculture should be prepared that this is what society may be asking us to do. At the very least, the agricultural sector needs to be concerned about public perception of agriculture's social responsibility and responsiveness to public concerns. This is particularly important given recent public efforts in this country to limit government's support of agriculture.

In Western Europe, a trend toward limiting the agricultural sector's influence on policy formation has already begun. A transfer of interests is beginning to occur from agriculture to

consumers and taxpayers. By way of example, the following amendments to the Common Agricultural Policy were adopted in the European Parliament last year (European Parliament Minutes, October 1989).

AMENDMENTS TO EC REGULATIONS NO'S.
797/85, 1096/88, 1350/78, 389/82, AND 1696/71
ADJUSTMENT OF AGRICULTURAL STRUCTURES

Priorities on Investment Aids to Agriculture in the EC

> ...to improve the quality of agricultural products;
>
> ...to reduce production costs,...,improve the living and working conditions of farmers, to promote the diversification of their activities,...,
>
> ...and to preserve and improve the natural environment and animal welfare by preventing undesirable intensive farming.

Specifically, two goals were added to agricultural policy, environmental protection and animal welfare which, given the environmental degradation that has occurred in many areas of Europe as a result of intensive livestock farming, they see as connected issues. Note especially the last item:

> to preserve and improve the natural environment and animal welfare by preventing undesirable intensive farming.

The amendments further specified that government support

> is not to be extended to investments aimed at increasing production capacity but rather at improving the quality of production facilities and improving health and hygiene on stock farms and animal welfare.

Restrictions on investments to agriculture apply only to investments in intensive livestock farming. Restrictions on investment aid do not apply to measures taken by farmers to protect the environment or increase animal welfare. In other words, farm support is decoupled from farmer-initiated investments that increase production and recoupled to farmer-initiated investments that improve the quality of the natural environment and the quality of life of farm animals.[20]

We should be aware that a transfer of influence similar to that experienced in the European

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[20]. In the end, however, the amendments were not adopted by the Council of Ministers in the form in which they had been proposed by the European Parliament. The Council, however, did adopt an amendment which specified that the Member States would be allowed to give aid for investments needed to comply with EC or national rules on farm animal welfare (personal communication, Andrew J. Wilson, Directorate-General for Agriculture, Commission of the European Communities, July 1991).

Community and Scandinavia is beginning in this country, that it is probably irreversible, and that it means agriculture will have to adopt a more conciliatory and cooperative approach to public concerns in the future.

In Western Europe, animal products from associations of welfare groups, producers, and processors are becoming available. The originators of these products are attempting to respond, not only to concerns about animal well-being, but about environmental quality, and food safety and quality. Consumers in Western Europe and Scandinavia are demanding new and further standards of quality that take into account production methods, the conditions under which animals are reared, and the type of rations they are fed. "The end product then is perceived as having been produced under environmentally acceptable conditions, and is 'wholesome,' nutritious, and safe to eat" (Thornton 1990). Food animal welfare is being seen more and more by these consumers as a food quality issue.

"NEULAND Meat Quality Program:
We Let the Sow Roam"

Figure 3.

Figure 3 is a brochure from a German open air market advertising welfare-compatible and environment-compatible pork. A very complete description of the rearing conditions is given in the

document. (An informal translation of the requirements is provided in the protocol, Appendix II.)

In 1988, the Swedish government enacted regulations to require that farms conform to certain production standards deemed critical to ensuring the welfare of farm animals. Ten years earlier it had issued a moratorium on the building of intensive hog confinement facilities. (Like much of Western Europe at the time, Sweden was over 100 percent self-sufficient in pork and also experiencing environmental quality degradation). Three years earlier it had banned the use of antibiotics at subtherapeutic levels in animal feeds to respond to consumers' human health concerns.

And, in 1987, an expert committee on farm animal welfare acting for the Canadian government recommended widespread inclusion of programs to promote farm animal welfare in Canadian university teaching and research, government decisionmaking, agricultural production, and veterinary services (Agriculture Canada 1987).

It is possible that current initiatives in behalf of animal welfare and animal rights may mark the beginning of a sea change in the value structure of Western society. Indications are that a new social imperative regarding the human-animal relationship is forming characterized by a less objectified, more intuitively caring view of non-human animals and, indeed, of the natural environment itself, in recognition of the interdependence of living things. Moreover, this subjective viewpoint is increasingly characterized by sympathy, a willingness to accept **on faith** that non-human animals are capable of subjective experience, experience quality of life, and that humans have a responsibility to provide for the quality of life of animals under human care or dominion.

Professor J. F. Hurnik, of the University of Guelph, has been studying the questions of agricultural ethics for some time. He has pointed out that the public concern about animal welfare in the course of food production is increasing in developed countries that have had a long history of concern about human rights and that this concern is in line with the evolution of human morality. It stems from growing human recognition that animals are able to experience "quality of life." Hurnik believes that "it is rational to assume that we are witnessing the beginning of an irreversible trend in human relationships to animals" (Hurnik, 1988). [21] He suggests that those involved in the business of agriculture would do well to keep this small fact in mind and take the initiative to self-administer progress toward welfare goals in food production. This has been suggested in the past, but our progress has been very slow in this direction (Muehling 1982; Harrison 1988).

In Western Europe and Scandinavia, commercially viable livestock production systems that provide for welfare of the animal are being developed. In Canada, efforts in this direction by Hurnik and Duncan, professors of Animal Science at the University of Guelph, are underway. There is no reason why a technologically advanced country such as ours should not be able, as well, to design production equipment, facilities, and training programs that will deliver to producers and other animal caregivers specialized knowledge and husbandry skills for profitable, welfare-compatible production.

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[21]. At the November 1990 Pickrel Seminar, hosted by the Department of Agricultural and Applied Economics of the University of Minnesota, Hurnik related an experience he had upon returning to his native Czechoslovakia following the recent political changes there. Prior to the changes, which restored individual freedoms to Czech citizens, there had been no activism in the area of animal welfare or animal rights. During his visit, he noted that following the changes, an association concerning itself with the welfare of animals had been organized.

How we in U.S. agriculture, as farmers, educators, researchers, legislators and policymakers, manufacturers and suppliers of farm inputs, retailers, and journalists, choose to respond to growing public concerns, not only about the welfare of animals, but about the environment, food quality and safety, and the sustainability of agricultural productivity is what I see to be the crisis and the opportunity facing agriculture and its supporters. For now, the decision is in our hands.

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APPENDIX I

GENERAL PROTOCOL FOR REARING HOGS FOR PASTURELAND FARMS LABEL
September 1989
(Paraphrased. Protocol may need to be varied to fit circumstances
on individual farms.)

Qualifications:

Family farms only. (Family owns farm and hogs and depends on farm for its livelihood. Family provides major part of labor for farm operation and for management of pigs.)

Producers are characterized by humane attitudes and are capable of highest level of husbandry.

Producers agree to inspection by Animal Welfare Institute and U.S. Department of Agriculture.

Producers agree to bi-monthly visits by veterinarian registered with Pastureland Farms program.

Housing:

All Pigs:

Free to move about through all phases of breeding, gestation, farrowing, and growing/finishing.

Have continuous access to bedded pens and/or pasture.

Straw is preferred bedding. Substitution can be made only with approval of Animal Welfare Institute.

Have access to straw or other approved materials for the purpose of providing occupation.

Gilts, boars, and gestating sows:

No close confinement in crates is permitted unless briefly required for vaccination, marking, or veterinary procedures.

Housed in pens in small groups with access to outdoors or on pasture with hog shelters.

Outdoor shelters must be sturdy enough to protect pigs from elements, including rain, wind, sun, heat, and snow.

Outdoor shelters must be bedded during winter and when spring and fall weather require it.

Sows and Litters. Indoors:

Each sow and litter must have bedded lying area with minimum of approximately 55-60 square feet (7.5 ft. x 7.5 ft.) of floor space.

Access to outdoors for nursing sows and piglets in mild weather is preferred but not required.

Windows providing natural light -- at least two windows per 1,000 square feet -- are required for sows and piglets that do not have access to outdoors.

No close confinement in crates will be permitted except in the rare event that a sow may savagely attack her piglets.

Sows and Litters. Outdoors:

Sows and litters must have constant access to bedded shelter providing protection from wind, rain, sun, heat, and snow.

Growing/Finishing Pigs:

Housed in bedded pens with continuous access to outdoors, or on pasture with sturdy shelters to protect pigs from elements.

Outdoor shelters will be bedded in winter and when spring and fall weather require bedding for warmth.

Weaning:

Weaning will take place at a piglet weight or age that considers the health and welfare of both piglets and mothers.

Weaning ages/weights will vary depending on breed of sow, level of milk production, sow age and health, and health of individual piglets.

Age of weaning will be not less than 42 days where this is possible. Weaning age may be less if necessary to protect health and welfare of the sow, e.g., if the sow is of a breed with high milk production and nursing a very large litter.

Piglets will not be taildocked. Male piglets may be castrated and needle-teeth may be clipped.

Medication and Feed Additives:

No nontherapeutic use of antibiotics or sulfas.

No somatotrophins, beta agonists, or other repartitioning technologies will be permitted,

should these become available.

Following therapeutic drug use, drug-withdrawal periods must be strictly adhered to. Treated hogs may not be sold until the required withdrawal period is met.

Medication and treatment of sick or diseased animals will be administered only under the supervision of a veterinarian.

APPENDIX II

DESCRIPTION OF FARMS AND REARING PRACTICES
FOR NEULAND (THE NEW LAND),
WELFARE-COMPATIBLE AND ENVIRONMENT-COMPATIBLE
PORK PRODUCTS, GERMANY*

Neuland description: Society for animal-compatible and environment-compatible livestock management. An association of farmers, animal protection workers, consumers, and environmentalists.

Neuland guidelines for hog production for its trademark:

Straw bedding for sows, piglets, and growing pigs. (Straw bedding makes running and lying areas softer, protects pigs from cold floors, prevents injuries, massages and cleans the skin, dries wetness, enhances rooting and nestbuilding, offers dietary fiber, keeps animals busy and reduces barn odor.)

Possibility to move. Pens, outdoor runs, or grazing areas required. Separation of lying and dunging areas, natural daylight, clean air, comfortable thermal environment.

Feed. Balanced and savory feed. For sows must consist of 80 percent from domestic field forage growers; for feeder pigs 90% from domestic field forage growers. Individual feeding places to control food rations. Automatic drinkers. Slow fattening with up to a maximum of 210 pounds growth in 130 days.

Farms. To ensure environment-compatible production, farms producing for Neuland must be family farm production units. Number of pigs per farm restricted to 60 sows plus their piglets, and a maximum of 300 fattening hogs. Production must be connected to amount of farmland. Produced manure is restricted to two animal manure units per hectare (equivalent to six sows with piglets or fourteen feeding pigs), with straw bedding only.

Pigs. Bred for stress resistance, good maternal abilities, and good meat qualities.

Management and housing. No nose rings; no taildocking or teeth clipping; no rapid fattening, only trough feeding; no feed additives to increase growth rate; no industrial hybrid pig programs.

Neuland helps farmers with advice and individual plans for changing to the animal-compatible and environment-compatible as well as quality oriented family farm production.

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* This is an informal and non-technical summary of the brochure (in German) shown on page 40, as rendered by Ulrich Hausner, a colleague in Department of Agricultural and Applied Economics.

APPENDIX III

THE SWEDISH CODE OF STATUTES
ANIMAL PROTECTION ORDINANCE
SFS 1988:539

(Edited and informally rendered to emphasize the case of swine production)

Rules regarding:

Livestock Buildings:

Sufficiently spacious to allow all the animals to lie down at one time, and to move freely.

So designed as to allow the animals to behave naturally.

So designed as to provide a satisfactory climate, with noise being kept at a low level.

Fitted with windows that let in daylight.

Buildings or parts of buildings designed to house horses, cattle, reindeer, pigs, ... , or furred animals may not be built, extended or remodelled without prior approval (by county boards) of the building with respect to animal protection and animal health. Same for buildings previously used for another purpose.

Livestock equipment:

Equipment and fittings in livestock buildings and other premises that house animals shall be so designed that they do not inflict injuries or entail risks to the health of the animals and shall not prevent the animals from behaving naturally, nor unwarrantably limit their freedom of movement or otherwise cause them distress.

Housing:

Breeding pigs shall be given the opportunity to stay outdoors in the summer, where possible.

Pigs shall be housed in loafing barns.

Equipment for immobilization of pigs must not be used other than temporarily.

Pens for pigs and for calves up to the age of one month shall be provided with litter bedding or similar material.

Drugs:

It is prohibited to feed animals with hormones or other substances in order to alter their characteristics for any other purpose than to prevent, establish the existence of, cure, or alleviate disease or symptoms of disease.

New Techniques:

The approval of new techniques shall be considered by the National Board of Agriculture.

New technical systems and new technical equipment for the housing of animals shall be approved with regard to animal health and protection before use. In addition, professional committees comprised of individuals with knowledge of specific livestock species will formulate any further rules and evaluate techniques respecting housing, management, and treatment of the particular livestock species regarding which they are expert.